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SEPTEMBER 2003

GameDeveloper

ON THE FRONT LINE OF GAME INNOVATION

Special Report:

Top 20 Publishers

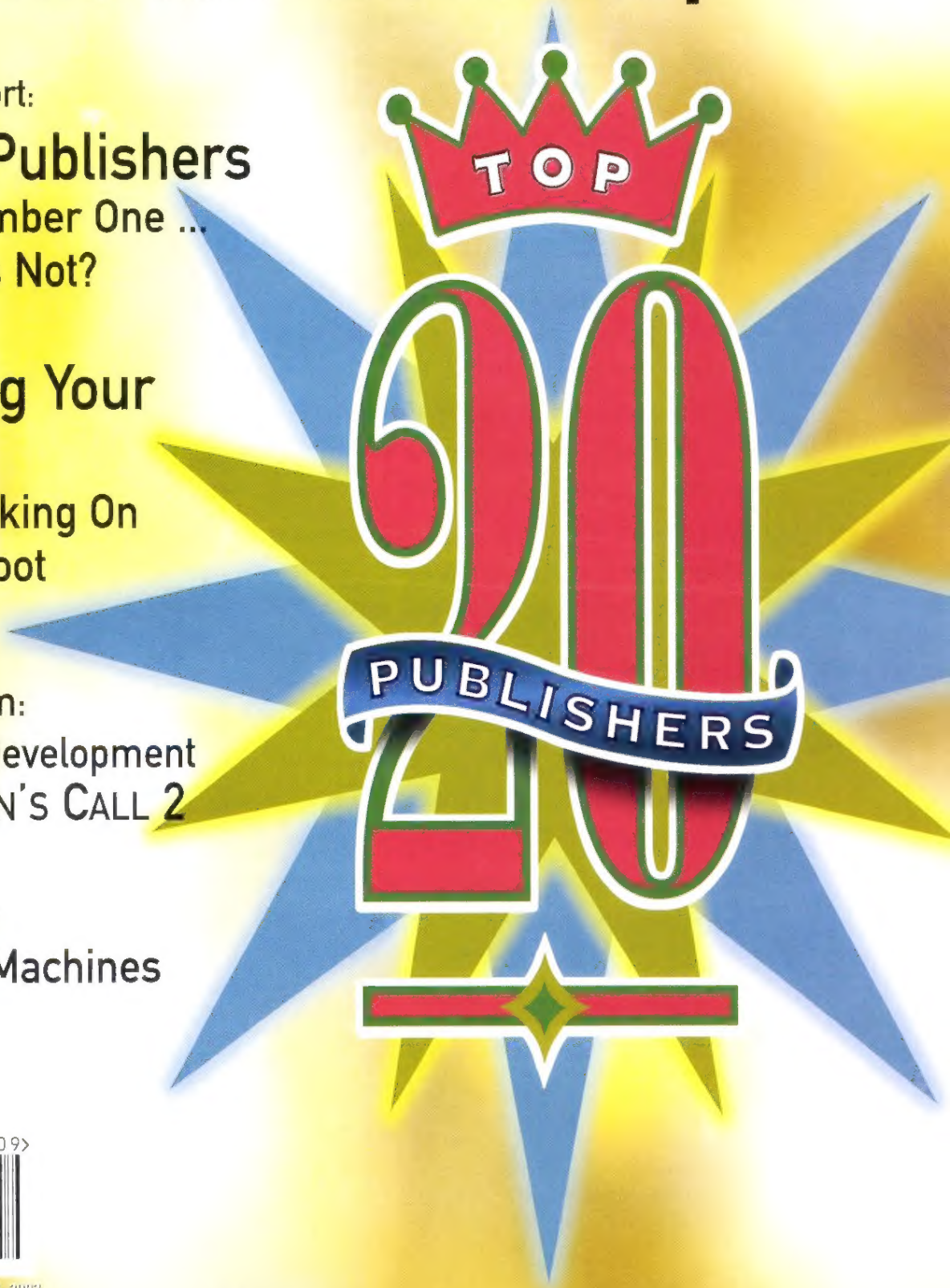
Who's Number One ...
And Who's Not?

Covering Your Assets

While Working On
A Film Shoot

Postmortem:
The Tools Development
Of ASHERON'S CALL 2

Games As
Learning Machines



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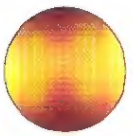
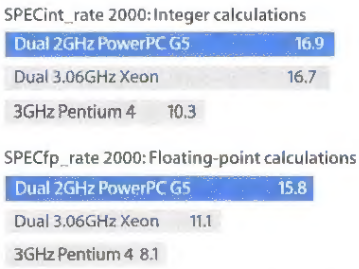


The PowerPC G5 chip. The world's first 64-bit processor for personal computers.

running at speeds up to 2GHz. And since these are 64-bit processors, they can access up to 8GB of memory in the Power Mac G5, which is double the 4-gigabyte memory ceiling of every other PC in the world. The G5 processors also have the world's fastest frontside bus, running at 1 gigahertz, which gets data to the processor almost twice as fast as the 533-megahertz bus found in the next-fastest personal computer (a dual 3.06GHz Xeon machine).


SPECint_rate 2000: Integer calculations
Dual 2GHz PowerPC G5 16.9
Dual 3.06GHz Xeon 16.7
3GHz Pentium 4 10.3
SPECfp_rate 2000: Floating-point calculations
Dual 2GHz PowerPC G5 15.8
Dual 3.06GHz Xeon 11.1
3GHz Pentium 4 8.1

Independent tests show the Power Mac G5 edges out the competition on integer and blasts past them in floating-point.

In side-by-side speed tests using industry-standard benchmarks, the dual 2.0-gigahertz Power Mac G5 is up to 41% faster than both the fastest Pentium 4 and dual-processor Xeon workstation. And the results get even better when using real-world applications: the new Power Mac G5 runs Photoshop more than twice as fast as the fastest PCs. Further tests reveal there are similar gains across a wide range of applications, from music and video to science and mathematics.

The PowerPC G5 chip is based on IBM's highest performance 64-bit supercomputer processors.

Impressed? We haven't even touched on the Power Mac G5's other features. Like its ultrahigh-bandwidth system architecture, featuring AGP 8X, PCI-X, FireWire® 800, Gigabit Ethernet, up to 500 gigabytes (yes, that's half a terabyte) of internal Serial ATA storage and a SuperDrive® for DVD authoring. All inside a stunning, professional-quality aluminum enclosure that features four discrete computer-controlled cooling zones for whisper-quiet operation. Together, they make the Power Mac G5 a true breakthrough in personal computing.

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CONTENTS

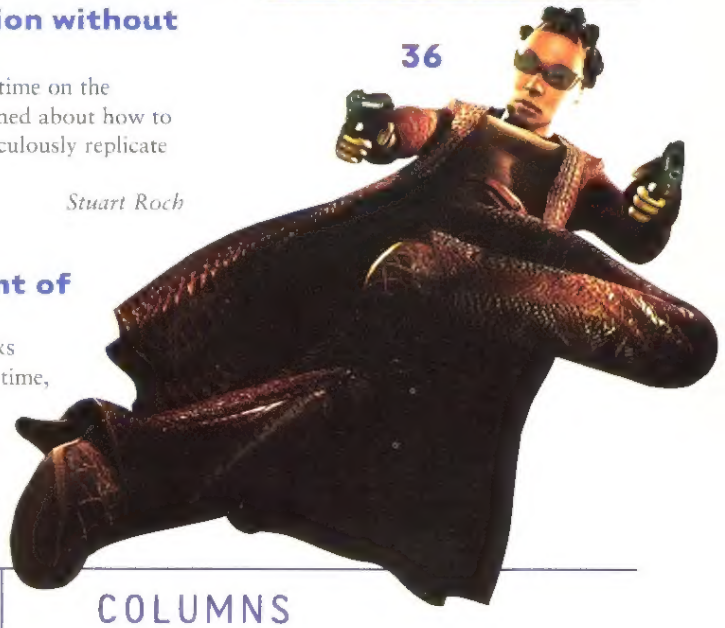
VOLUME 10, NUMBER 9
September 2003

FEATURES

30 *Game Developer* Reports: Top 20 Publishers
For the first time anywhere, the world's leading game publishers are deconstructed from the developer's perspective: original IP versus licenses, internal versus external development, platform and genre breakdowns, and so much more.
Tristan Donovan

36 Action! Gathering Assets on Location without Getting Crushed
For ENTER THE MATRIX, Shiny's developers spent a lot of time on the *Matrix* film sets gathering assets. Find out what they learned about how to work efficiently alongside a film production crew to meticulously replicate the movie's sound, feel, and look in their game.
Stuart Roch

42 Postmortem: The Tools Development of Turbine's ASHERON'S CALL 2
With ASHERON'S CALL 2, *Game Developer* once again looks beyond a game's main development and delves deep. This time, we focus on what went right — and wrong — in Turbine's development of the tools needed to update their MMORPG.
Paul Frost



DEPARTMENTS

4 **GAME PLAN** *Jennifer Olsen*
Surveying the Publishing Landscape

6 **INDUSTRY WATCH** *Jamil Moledina*
Activision sues, SEC investigates, Nintendo wins, Discreet updates, and more

10 **PRODUCT REVIEWS**
DarkBASIC Pro, Deep Paint 2.0, *Advanced 3D Game Programming with DirectX 9.0*

14 **PROFILES** *Everard Strong*
The king of Mythic's round table, Mark Jacobs

COLUMNS

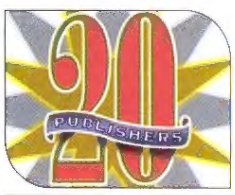
16 **THE INNER PRODUCT** *Jonathan Blow*
Using an Arithmetic Coder: Part 2

22 **ARTIST'S VIEW** *Hayden Duvall*
15 Things All Artists Should Know: Part 1

26 **SOUND PRINCIPLES** *Adam Levenson*
One Man's Foley Is Another's FX Nightmare

28 **BETTER BY DESIGN** *Noah Falstein*
Trumping Consistency

56 **SOAPBOX** *James Paul Gee*
Turning Games into Learning Machines



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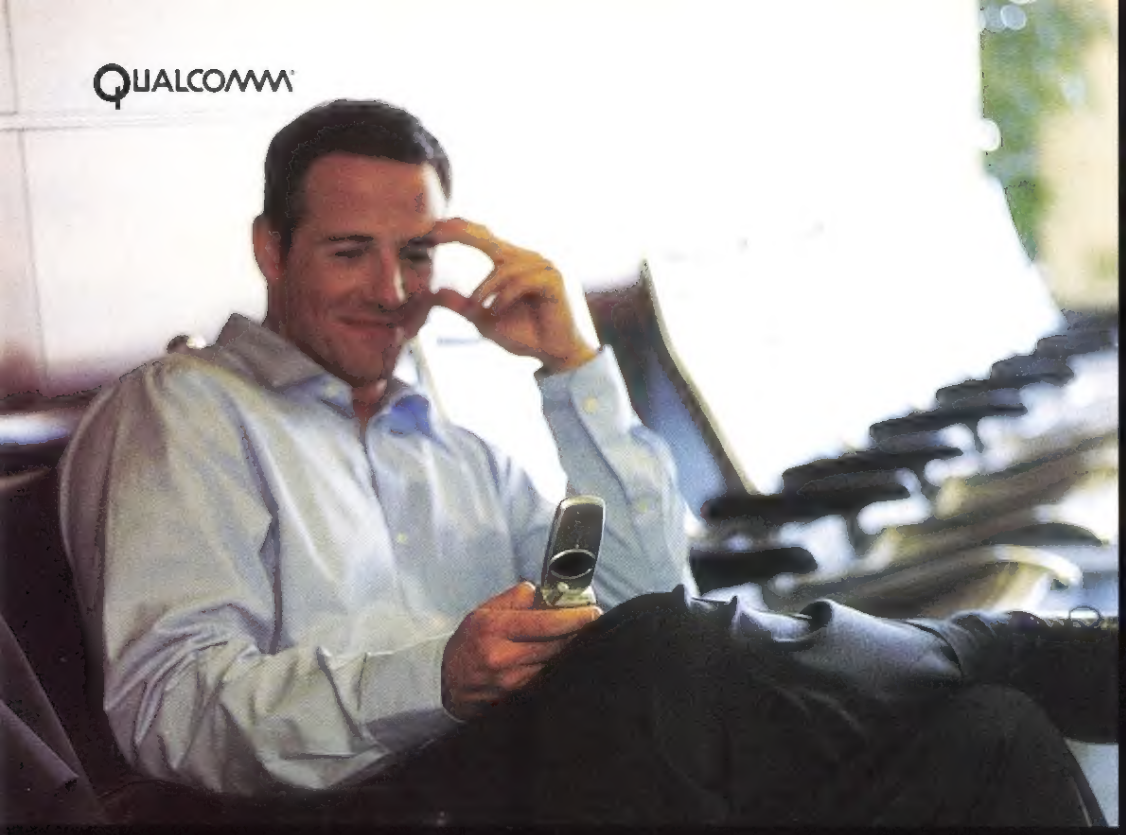

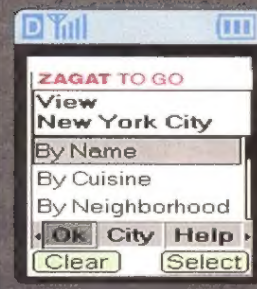

Navigation

Games

Ringers

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GAME PLAN

LETTER FROM THE EDITOR

Surveying the Publishing Landscape

Any great partnership can be characterized by the quality of its sum being greater than its parts. Developers and publishers have long benefited from a form of symbiosis in their respective courses of evolution, but the escalation of the business in the past few years has brought developers both uncertainty and opportunity, confusion and validation, and more than a few heartbreaks to offset its millionaires. Natural selection bears its fangs.

In such a hospitable environment of contradictions, generalizations enjoy abundance: "Publishers only do sequels and licenses!" "It's impossible for third-party developers these days!" "The French are taking over!" "They're all just out to screw us!"

The business is changing, but is it really as bad as all that? To find out, we set out to analyze the Top 20 game software publishers in the world. We dug up release lists and analyzed the output of sequels and licenses. We figured out the percentage of each publisher's reliance on outside development. For those who have ever lamented working with a good producer at a bad publisher, or a bad producer at a good publisher, we surveyed willing developers on their relationship experiences with their partners, also incorporating feedback regarding milestone payment efficiency and level of creative involvement.

When I first discussed the idea of putting this report together with its author, Tristan Donovan, we debated the right number of publishers to include: Ten? Fifteen? Twenty-five? We realized there are a lot more small publishers still very much afloat than we had thought, many of whom aren't represented in our Top 20 but are still eking out a perfectly respectable living through niche markets or geographical specialization.

Meanwhile, one of our 20 has a sticker shock–inducing "for sale" sign planted out front (warranty not included), one erstwhile stalwart gave up the ghost during the course of our research, and a few others teeter on the brink with ever more arresting precariousness, causing us to wonder whether our Top 20 might yet end up smaller in number somewhere between our printer and your mailbox.

That a 20-year-old French company with a rainbow-colored armadillo for a mascot would suddenly and brazenly affix the Scarlet Atari to its chest added some absurdist flair, but we'll all get used to it in time. The SEC opened investigations into four of the Top 20 for the extremely impolite-sounding practice of "channel stuffing," investigations which at press time looked to be ongoing for the conceivable future.

Though the companies on our list represent more than $11 billion in worldwide game software sales, the business is still fraught with uncertainty. As long as uncertainty propagates to the analyst and investor level for game publishers, their long-term growth strategies will battle quarterly forecasts head-on, leaving developers on the creative and financial fence. Whether you love your publisher or hate them, whether you have a plum deal or a rotten apple, the future of the commercial game industry is in their hands.

Shop talk. Also this month, longtime Artist's View columnist Hayden Duvall drops the bomb that he will shortly hang up his writing hat: October will be his last column. While I look forward to revealing his eager successor in November, Hayden's lively personality, replete with irreverent humor that never fails to smart with the sting of truth, will be irreplaceable and greatly missed. Now that Hayden has hopped the pond to Garland, Texas, will this give him more time to help finish that game 3D Realms is working on?

Jennifer

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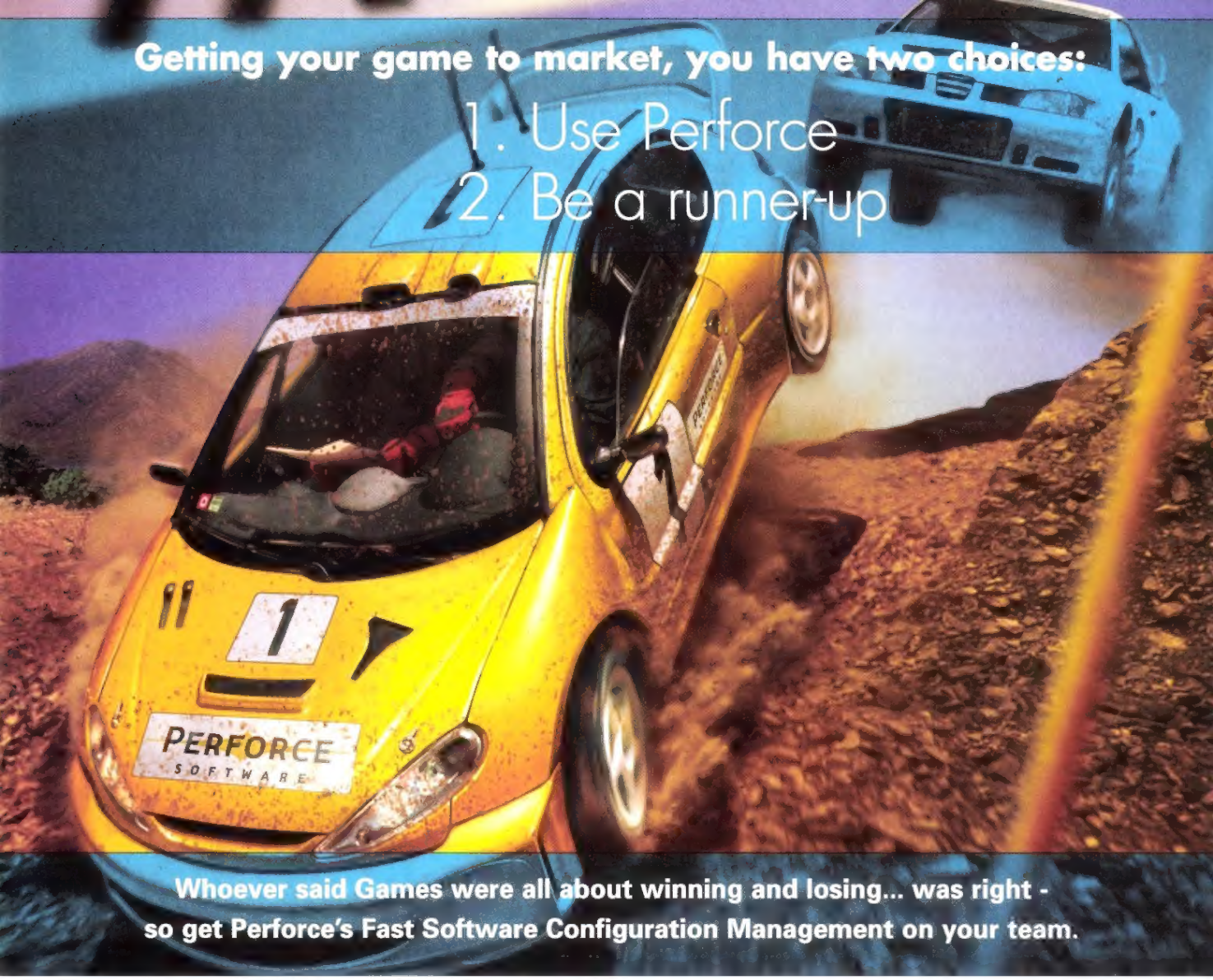
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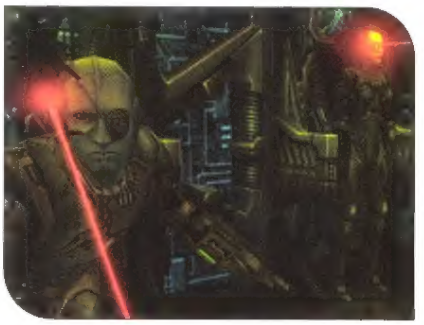
INDUSTRY WATCH

KEEPING AN EYE ON THE GAME BIZ | *jamil moledina*

Judge blocks videogame violence law. U.S. District Judge Robert Lasnik ordered an injunction blocking the enforcement of Washington state's recently passed legislation restricting the sale of violent games to minors. The bill would have fined retailers $500 for selling a game depicting violence against law enforcement officers to anyone under the age of 17. The Interactive Digital Software Association (IDSA) and the International Game Developers Association (IGDA) joined the lawsuit arguing that videogames are protected by the First Amendment. In a nine-page opinion, Judge Lasnik wrote that the plaintiffs had "raised serious questions regarding the constitutionality of [the law]."

Activision sues Viacom, phaser on stun. Activision filed a breach of contract lawsuit against Viacom alleging that it allowed the *Star Trek* franchise to stagnate. Activision said it was terminating its agreement to license the *Star Trek* property because Viacom, through its subsidiary Paramount, released only one *Star Trek* film in the five years since the agreement was signed, has no plans for more films, let two *Star Trek* shows go off the air, and did not coordinate the development and marketing of *Star Trek* films and television shows with that of Activision's STAR TREK games. Activision's current STAR TREK title is Ritual's STAR TREK ELITE FORCE II.



Star Trek licensee Activision, publisher of STAR TREK ELITE FORCE II, is suing licensor Viacom over the franchise's poor performance.

SEC investigates U.S. videogame publishers. Acclaim, Activision, Midway, and THQ filed reports indicating that they are under investigation by the Securities and Exchange Commission (SEC). None of the companies has been formally accused, although the companies' filings indicate that the investigation is "focused on certain accounting practices common to the interactive entertainment industry, with specific emphasis on revenue recognition."

Nintendo forces pirates to walk the plank. In a Hong Kong court, Nintendo won a HK$5 million (U.S. $641,000) judgment against Lik Sang, which made a device that enables the piracy of Game Boy software.

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THE TOOLBOX

DEVELOPMENT SOFTWARE, HARDWARE, AND OTHER STUFF

NewTek gives more textures. NewTek recently released Texture Collection, Third Edition, a set of 50 high-resolution JPEG images. These include textures such as wood, metal, sky, nature, and stone. All are available as a free download. www.newtek.com

Turbo Squid improves 3DS Max plug-in. Turbo Squid released an updated version of its 3DS Max plug-in that enables complex rendering in large (more than 50 million polygons) scenes. The FinalRender Stage-1 plug-in supports distributed rendering and includes effects such as 3D motion blurring, light dispersion, and sub-surface scattering. The plug-in is available now for $795. www.turbosquid.com

Khronos Group extends cross-platform programming. The Khronos Group launched OpenML 1.0 SDK, a cross-platform software development kit for manipulating digital media, that runs on both Windows and Linux. Khronos also ratified the OpenGL ES 1.0 standard, which enables mobile devices to support advanced graphics. Both OpenML 1.0 SDK and OpenGL ES 1.0 are royalty-free downloads for developers. www.khronos.org

Discreet announces 3DS Max 6. Discreet is planning a fall release for 3DS Max 6, the latest version of its 3D modeling and animation software. New features include advanced schematic view, integrated Mental Ray rendering software, vertex color painting, interchange support with CAD tools, distributed network baking, a particle flow system, and other enhancements. 3DS Max 6 will be available this fall for $3,495. www.discreet.com

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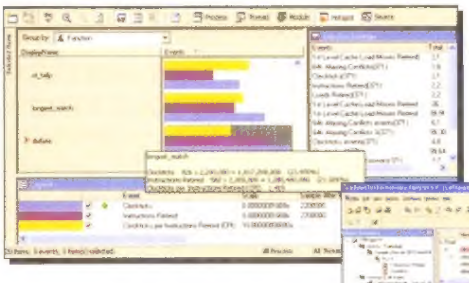

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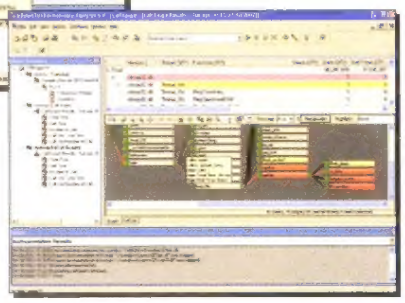

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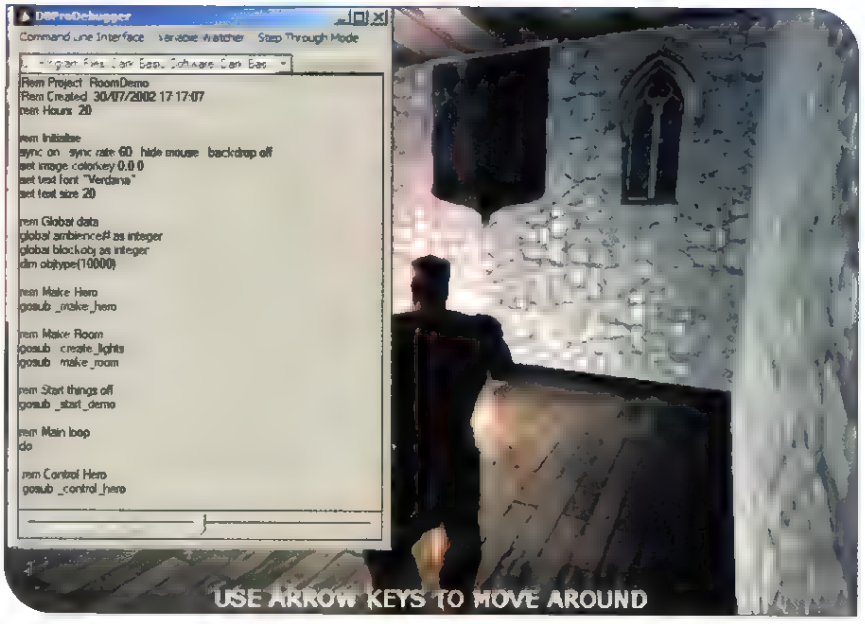
DarkBASIC Professional

by justin lloyd

DarkBASIC Professional is a modern, structured BASIC dialect with a lot of commands specifically for handling games using DirectX. It's capable of turning out a 2D platformers and 2D shooters as easily it handles 3D first-person shooters, both indoor and outdoor; in other words, anything you can create in C++/Win32/DirectX, though the learning curve is shallower. An ideal scripting language for game designers and game programmers in a rush to try out a new idea, DarkBASIC allows you to get something up on-screen quickly and with minimum fuss, and from there take it all the way through to conclusion, including burning the gold master.

Unlike previous versions, the current release is a native Windows IDE that provides an editor and integrated compiler. The editor is reasonably well featured but is still primitive in places. The IDE is capable of its designed task, but little more. It handles multiple source files, assets, version numbering, and a TO DO list.

The BASIC compiler turns out real machine code, and an included source-level debugger provides basic features — such as breakpoints — plus single-step and variable watches, both auto-scope and user-defined. The compiler turns out standalone executables with the ability to bundle any additional DLLs and assets into a single executable file, and it also removes any unused portions of the DarkBASIC libraries. Once the executable is generated (with or without bundled assets), it can be automatically compressed and encrypted to create smaller and more secure distributables.



A screenshot showing DarkBASIC Pro's debugging feature

Graphics capabilities. DarkBASIC is created specifically for manipulating the DirectX API in a simple and easy way. It handles all of the DirectX 8.1 features, providing ample facilities for 2D — using the DirectX sprite interface — and 3D graphics, plus input and audio. Initialization of a full-screen or windowed DirectX application is as simple as either setting the startup options in the project explorer or issuing a BASIC command that dictates screen resolution along with windowed or exclusive mode. The project settings also control the type of executable that is created — whether it is standalone or a Windows installer.

The 2D sprite system is very capable, handling animations, movement, and collision between sprites. The 3D side is an even more comprehensive command set for graphics and math, covering vectors, matrices, Catmull-Rom and Hermite splines, plus all the usual trigonometry commands found in other modern BASIC dialects. The 3D graphics handle the usual rendering of polygons, loading of 3D objects from disk, and creating primitives at run time, plus commands to control the individual joints on a boned object and real-time mesh deformation

JUSTIN LLOYD | *Justin has over 18 years of commercial game programming experience on almost every released platform.*

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Anthro

excellent
very good
average
disappointing
don't bother

with direct support for a lot of popular model formats, including QUAKE 2 and 3, HALF-LIFE, DirectX, and 3DS Max.

Advanced texturing and rendering techniques using bump-mapping, environment mapping, and multitexturing give the shine to games, along with support for hardware shadows, vertex and pixel shaders, and even a built-in cartoon shader. Rounding out the graphics capabilities is a general-purpose particle system with specific support for the unique properties of snow and fire particles.

Camera control allows for multiple simultaneous cameras for multi-viewport rendering to either the back buffer or a bitmap. A camera is moved around dynamically via code or the tracking feature that makes it follow another object. One of the nice features of the camera controls I explored was the intelligent navigation. By placing invisible static collision boxes in a scene, the camera will attempt to avoid entering the boxes. Scene lights are fully controllable, generated either in a level editor or dynamically at run time, with commands for spot, point, and ambient, along with control of fogging distance.

Object collision detection is handled automatically, and once a collision has taken place, DarkBASIC can either automatically move the colliding objects apart or leave it up to the programmer to determine the exact outcome. The collision command set provides raycasting tests for user-determined collisions and probing.

DarkBASIC renders indoor and outdoor 3D scenes equally well with PVS and BSP support and a capable terrain engine that loads BSP worlds, handling the culling, texturing, and collision automatically. There's a bundled BSP compiler that's installed with the IDE, and a programmer can generate dynamic terrain from height map files at run time.

Other features. Beyond the graphics features, provision is made for input from keyboard, joystick/joypad and mouse, along with force-feedback capability. There are also extensions available for free from the DarkBASIC support web site that interface with a VR glove and USB light gun. The language provides strong audio support: streaming CD audio, MIDI and MP3 playback for music, and WAV and other formats for the sound effects, all of which can be processed as 3D positional audio. It is also possible to capture directly from the microphone, useful for networked games. Video, either from an AVI/MPEG file or DVD can be mapped on to a texture in real time and then wrapped around an object.

DarkBASIC features two command sets that deal with network communication. The first is for accessing FTP sites where you can retrieve or store any data you want — this feature can be used for sending high scores to a remote server, downloading the latest patch or level pack for an established game, or even automatically upgrading the game from unregistered to registered. The other command set handles multiplayer games via LAN or TCP/IP using a peer-to-peer or client/server architecture.

Documentation and Help. The spiral-bound manual covers the BASIC command set, divided so that it deals with a specific area: 2D sprites, 3D objects, vectors and matrices, memory manipulation, and so on. Each BASIC command is given a brief paragraph of information and the syntax required. The manual does have a few weaknesses: For one thing, it doesn't supply brief examples of how to use commands. Often many commands will work in conjunction, and the user must infer how they bolt together. Many, but not all, of the commands are covered in the online examples replete with source code, and the online help provides more comprehensive information with small code snippets. I don't see the need for the physical manual — either bring it up to the level of the online documentation or abandon it all together.

Last word. DarkBASIC is a great tool for developing both complete games and quick mock ups, yet it has been overlooked by many professional game developers who couldn't imagine that BASIC could be up to the challenge of creating a modern game with sophisticated graphics.

The company announced it was about to post a public beta of DarkBASIC 5 on their web site, which will have many improvements, including support for the .FX shader format, and pixel accurate selection of objects during gameplay.

STATS

Game Creators Ltd
Wigan, Lancashire, U.K
Fax +44 (0)8451 275 338
www.darkbasic.com

PRICE
$99.99

SYSTEM REQUIREMENTS
Recommended. Pentium III 733MHz or above, 128MB RAM, DirectX-compatible graphics card with at least 32MB RAM and hardware 3D acceleration DirectX compatible sound card, 16x CD-ROM. 400MB hard drive space

PROS

1. Simplifies access to all aspects of DirectX.
2. Allows you to quickly get an idea up and running.
3. Once the framework is in place, designers can treat it just like scripting.

CONS

1. Requires CD or USB dongle to be inserted in the machine at all times.
2. Can be clumsy to express some ideas due to lack of object-oriented features.
3. Lack of professional production features could make it difficult to integrate in to a professional development environment.

Right Hemisphere's Deep Paint 2

by sean wagstaff

Rather than trying to compete with Photoshop head-on, Right Hemisphere has wisely set up Deep Paint as a companion to Photoshop and has included import and export functionality, along with a Photoshop plug-in that lets the two work together. As a result, you can paint with Deep Paint's unusual depth-mapped brushes, while retaining the fine control and extensive tools of Photoshop.

Deep Paint 3D's user interfaces allow artists to customize their textures and brushes

Version 2 of Deep Paint introduced a number of useful new features, including greatly enhanced cloning tools for painting based on the underlying pixels in imported layers, and spline tools that can be used for accurately creating masks or for creating stroke paths for various brushes.

Chief among Deep Paint's unusual features is the capability to paint with textures, including bump mapping and specularity, in addition to using basic colors.

Game artists will appreciate the capability to create their own texture brushes by creating their own sets of color, bump, specular, and alpha maps, and then using these brushes to paint the textures into an image.

In addition to texture brushes, Deep Paint does an impressive job of simulating wet and dry paints that mimic real world materials, including thick, gooey oil paints and other materials where depth and specular shine are an important element.

Deep Paint has always let you set lighting that is automatically rendered on the bump-mapped surfaces of your painting, and you can choose to retain this rendered lighting for use in your textures, or to omit the feature if your rendering engine is going to use the bump maps you've created.

Typically, the texture-mapping workflow involves exporting UV maps to an image file and then painting over these maps to achieve the desired texture. Deep Paint's texture brushes make this easy, although unlike Deep Paint 3D, the 2D version has no 3D object painting features of its own.

I was impressed with Deep Paint's ability to render realistic-looking alpha-, depth-, and specular-mapped textures in 2D paintings, but for game artists, Right Hemisphere could add a number of features to make it more useful. Primarily, the software needs the capability to view, edit, and export the underlying effects channels that control these effects. Even for 2D artists who simply want deeper-level control over their images, more control over the underlying channels would be a good thing. I'd also like to see a wrap-around feature in the brushes that would let us paint textures that automatically tile seamlessly.

Deep Paint 2 is available for Windows 98/NT 4/2000/XP for $249 ($49 for an upgrade). As an add-on to Photoshop, it's a valuable addition to the creative toolbox.

★★★★ | Deep Paint 2
Right Hemisphere
www.righthemipshere.com

Sean Wagstaff is a freelance 3D modeler. Contact him at sean@wagstaffs.org.

Advanced 3D Game Programming with DirectX 9.0

by Peter Walsh and Adrian Perez

[illegible] Jeremy Jessup

Peter Walsh's *Advanced 3D Game Programming with DirectX 9.0* covers a broad range of subjects critical to making games: graphics, artificial intelligence, networking, and mathematics. Priced at $60, the book contains 11 chapters that span approximately 520 pages.

"Windows," the first chapter, describes how to create a window and respond to some of the common Windows messaging events. The chapter defines several custom classes that loosely resemble code created by Visual Studio's workspace wizard but cleaner and with a Win32 flavor. These classes form the framework for a generic Windows game.

The next three chapters ("Getting Started with DirectX," "DirectInput," and "DirectSound") show how to compile and link DirectX with your application and initialize two of the subsystems found in DirectX, DirectSound, and DirectInput. The DirectInput and DirectSound chapters focus on initialization rather than exploring the more sophisticated uses of each system such as force feedback or dynamic audio mixing.

Chapters on 3D math, artificial intelligence, and networking follow. The math chapter provides basic math definitions including the dot and cross products as well as container classes for vectors and matrices. The AI chapter is brief; readers seeking to gain a deeper understanding should read the chapter in conjunction with a decent college text that describes fundamental search routines such as A* or Djkstra's algorithm. Finally, the networking chapter relies on WinSock without mentioning DirectPlay. While all three chapters are essential to game programming, given the space provided, none of them adequately covers the complexity and nuances of each subject given.

The rest, and the best, of the book discusses rendering. Beginning with lighting and fog parameters, Walsh explores several sophisticated graphics techniques including the mathematics of animation, subdivision of surfaces, radiosity, and progressive meshes. Examples of multipass texture mapping are provided to illustrate various DirectX render states, but despite featuring DirectX 9.0, many of the new SDK features — such as vertex and pixel shaders — were missing from the text.

Sample code is available online, but upon dowloading and trying to run them, three of the four programs crashed and my computer needed to be rebooted.

Overall, this book's title is at odds with the subject matter. It provides an overview of the basic theory, API calls, and usage, but instead of offering more details, the reader was often referred to the DirectX SDK help. As an experienced game developer, I found very little of value in this book. None of the topics are explored adequately, leaving the seasoned reader with nothing but an unsatisfying overview and possibly a reference to the DirectX SDK help file.

★ | *Advanced 3D Game Programming with DirextX 9.0* | Wordware
www.wordware.com

Jeremy Jessup has been developing games professionally for nearly five years.

Life in Camelot

Mythic's Mark Jacobs on MMORPGs and the Self-Publishing Gamble

Mark Jacobs has been creating pay-per-play games since 1984, with the release of his DRAGON'S GATE MUD. From that day on he has kept his main goal of "creating an [MMORPG] that will encompass all relevant media" front and center in his game development plans.

Co-founding Mythic Entertainment in 1995 with the prime goal of providing online entertainment to mass audiences, Mark's vision has come very close to reality. Mythic's DARK AGE OF CAMELOT took 18 months from concept to a self-published release, and has become one of the biggest MMORPG success stories. The studio is gearing up to start work on a new MMORPG title, IMPERATOR, which takes place in a universe where the Roman Empire never fell.

Mythic's own King Arthur, Mark Jacobs is ready to face new challenges on the MMORPG front

In a development world where self-publishing a AAA game is becoming increasingly rare, *Game Developer* spoke with Mark about taking control of a company's destiny.

Game Developer: DARK AGE OF CAMELOT is one of the few very successful MMORPG titles. In your opinion, what about the game makes it stand out from others in the genre?

Mark Jacobs: First, we had a very stable launch. With minimal downtime (due to crashes, updates, and so on), rock-solid servers, and a stable client, we were able to build on the initial demand for the game. Second, we were — and remain — the best implementation of a combined PvE/PvP system to date. Third, we had the broad appeal of the Camelot legends to draw on. Finally, Mythic is committed to making DAoC the number-one MMORPG in the industry, which has allowed us to have a high conversion rate (the number of players who become subscribers) and retention rate (how long players stay as customers). While other developers say this too, we have backed this up with spending a ton of money on improving the game through both subscription-based updates and retail expansion packs.

GD: How many teams does Mythic currently have working on titles? Do these teams collaborate on different projects?

MJ: Right now we have one full team dedicated to improving DAoC. While there are two components to that team (expansion and live), they are treated as one. When we begin work on IMPERATOR, our newest MMORPG, some people will work exclusively on that game, but others will work on both games at once; thus, as we add things for IMPERATOR, many of the applicable improvements will also go into DAoC. We are also in the process of hiring new people to add to both DAoC and to IMPERATOR.

GD: How long did it take between DAoC's initial development and the signing of your first player? How has that differed from past development schedules and why?

MJ: In the past, Mythic had anywhere from six to nine months to create a game. Taking 18 months, DAoC was the longest development cycle ever for us, the reason being that for the first time we actually had enough funding to develop a top quality game.

GD: Mythic self-published DARK AGE OF CAMELOT (with help from Abandon). Going into that decision, what were your expectations about the process and what turned out to be the reality?

MJ: We knew there would be a host of problems associated with the release, but that if we did our jobs everything would be fine at the end (or at least that's what we told ourselves). We ran into very few unexpected problems, and for the most part the reality — other than the exceedingly large demand for the game at launch (the number of subscribers we got in the game's first week was what we had projected for the first month) — was exactly what we were expecting. Luckily, we have been extremely successful and are, for the first time, able to be in control of our own development path for the foreseeable future.

On a personal level, my expectations were that if DAoC failed, my next job would involve hairnets, nametags, and the phrase "Would you like fries with that?"

GD: Without Abandon's financial investment early on in the game's development, how close were you to that scenario?

MJ: We would not have been able to create DARK AGE OF CAMELOT without Abandon's investment. They acted as a co-publisher for us then. If we hadn't had that investment, we would have been in a very tough position.

GD: Say my studio is considering self-publishing our next title. What scorecard should I use to assess if this is a viable move or not?

MJ: First, make sure that you are realistic in setting the development schedule. Second, once you set the schedule, add at least 25 percent to it (give or take a certain amount based on how many other games you have done). Third, make sure you have enough money to cover this new schedule. If you can't cover your finances, you shouldn't be self-publishing, especially if it's your studio's first game.

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Using an Arithmetic Coder: Part 2

In a client/server game system, we want to transmit as much data as we can through a limited amount of bandwidth. An example of such data would be the server telling the client the states of all objects in the world. Last month in "Using an Arithmetic Coder: Part 1" (August 2003), we saw how an arithmetic coder can help us efficiently pack data values into network messages at sub-bit precision. This system produced no gaps between the individual values, which saved space, especially when values were small.

But if we want bigger space savings, we might compress the transmitted data outright. We could do this with a relatively brute-force approach, such as linking the free "zlib" compression library into our game, sending it our network messages as arrays of bytes, and telling it to compress those arrays. There are a lot of reasons why this isn't a good idea, some of which will become clear as I discuss alternatives in this column.

Arithmetic coders are great at compression, and there are some excellent references — such as the *CACM87* paper — that explain the basics of arithmetic coding compression (see For More Information at the end of this column). Here I'll try to provide some alternative views not found in the references. I'll also discuss ways we as game programmers need to approach arithmetic coding differently from the mainstream.

Probabilities

Just like last month, we encode a message by mapping it to a small piece of the interval [0, 1). Compression occurs by transforming values so that common values take up large pieces of the interval, and rare values take small pieces. The ideal amount of space that any value or message can be compressed into is $-\log_2(p)$ bits, where p is the probability of that message. Don't be confused by that negative sign; since p is always in [0, 1) by definition (it's a probability), the log always produces a result that is negative or zero, and the negative sign just reverses that. In Figure 1, I've tried to illustrate why it takes fewer bits to encode a bigger subset of the unit interval. You can think of the active principle as "The smaller something is, the more precisely you must describe its location in order to guide someone to it."

Starting with the interval [0, 1), for each value we want to pack, we pick a fraction of the current coding interval that's equal to that value's probability and shrink the coding interval to that new subset. Last month, in order to pack a value into a message, given n possibilities for the value, we would just subdivide the current coding interval by n. That's the same as treating all the possibilities as though they were of equal probabilities. So essentially, this month we're just going to improve our model of the data's statistics.

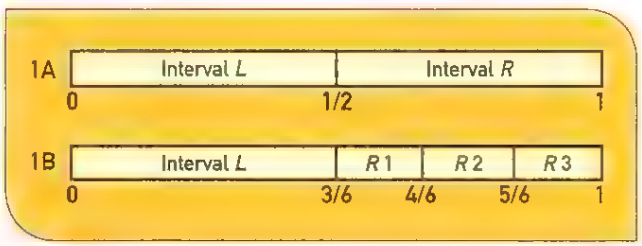

FIGURE 1A The unit interval divided into two equal pieces, spanning [0 1/2) and [1/2, 1). To specify one of these pieces, we only need one digit after the point. Binary .0 (0 decimal) indicates interval *L*, since any number starting with .0 lands in the range [0, 1/2). Likewise, .1 is sufficient to denote *R*, since any number starting with .1 lands inside *R*.
FIGURE 1B Interval *R* has been subdivided. The number .0 is still sufficient to specify *L*. However, .1 now could indicate any of the three intervals on the right; we need more digits to specify which.

Conditional Probabilities

Figure 2 shows two different illustrations of this process of encoding a string of values. Figure 2a illustrates the recursiveness of the concept, showing how we zoom in on one tiny piece of the unit interval. Figure 2b takes a more aloof viewpoint, looking at the set of all possible messages we could transmit and their relative probabilities. It's a little more cluttered, but it's useful because it helps clarify some aspects of message probabilities.

To get the best compression, we want to look at the set of all possible messages we could transmit and ensure that each of those messages maps to a piece of the unit interval of the exact size dictated by its probability. Our goal is to compute $P(y_0 = k_0, y_1 = k_1, \ldots, y_n = k_n)$, the probability of the final

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composite message. If the y_i are statistically independent, the compound probability just becomes the product $P(y_0 = k_0)P(y_1 = k_1) \ldots P(y_n = k_n)$, and the answer is simple to compute, since we don't need context around any single value. But this criterion of independence almost never holds. Thinking of this probability as being a divisible and well-ordered thing is probably a mistake. Certainly nothing in reality limits the dependencies to flowing forward along with our indices on y. For a particular problem, we might need to compute $P(y_3 = k_3 \mid (y_5 = k_5, y_9 = k_9), \ldots, y_1 = k_1)$, and that is still a tremendously simplistic way of looking at the problem.

I bring this up in such an annoying fashion because data modeling for arithmetic coders is usually explained the way text compression people see the problem. In that paradigm we have a bunch of uniformly sized symbols, and we run through some example data to build tables giving us a 0th order or 1st order or *n*th order model of the data, which we then use for compression, perhaps adaptively. I find this mode of thought limiting when it comes to approaching general problems. As an example, Claude Shannon, the father of information theory, did a number of experiments to compute bounds on the actual information content of the English language. The results of these experiments can tell you approximately what compression ratio you'd get out of a very good compressor. Shannon found an upper bound of about 1.3 bits per character and a lower bound of half that; these numbers are much lower than the ratios achieved by the current best compressors. (For some example compression statistics, see Charles Bloom's web page in For More Information.) Evidently, given an AI that understands English as well as a human, you could use its predictions of upcoming text to build a much better compressor than we currently know how to make.

Such an AI would perform well because it contains much knowledge about the behavior of English. This is not strictly a model of the way letters tend to follow each other in text; on a deeper level it's a model of what the author of the text was trying to accomplish by writing the text. Actually, it's even deeper than that: it's a model of the kinds of ways people tend to behave, allowing us, upon encountering a text, to generate a more specific model of what the text is intended to achieve. My point is this: Any knowledge you can exploit to predict the probability of a message is fair game. It doesn't have to be information actually contained in the message.

Sample Code

This month's sample code (which you can download from the *Game Developer* web site at www.gdmag.com) is a file compressor. And to compress files, we will use only information contained within the files. But this is all because the code is written to be as simple as possible, to be easy to understand and build on. It provides two options for compression: order 0 modeling (no context around each character) and order 1 modeling (one character of previous context is used to guess the probability of the current character). The code reads from an example English text file in order to build a static probability model for the expected data. It then uses that model to compress a different file.

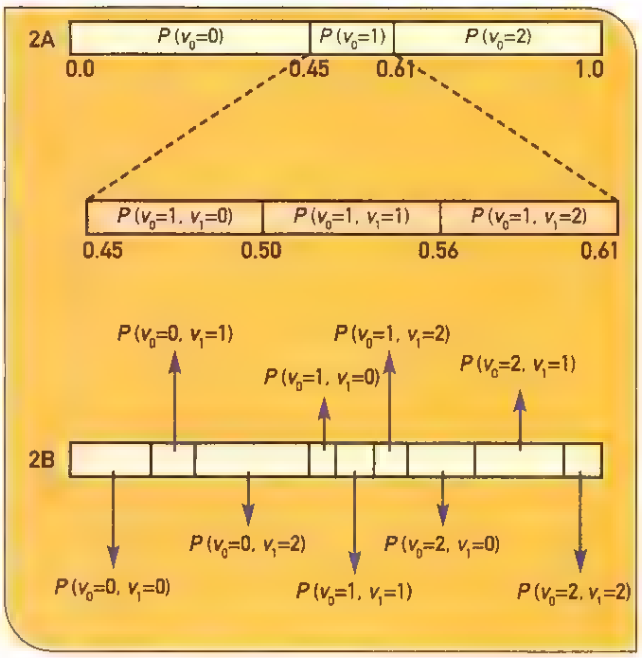

FIGURE 2 Suppose we create a message by packing together two variables v_0 and v_1, each of which can take on the values 0, 1, or 2. Figure 2A shows the process of finding the appropriate piece of the unit interval for the case when $v_0=1$. Figure 2B shows a bird's-eye view of all message possibilities.

Most arithmetic coding text compressors use adaptive modeling, but this one does not. Adaptive modeling is a method of modifying the probability tables to fit the file's usage patterns, as pieces of the file go streaming by. The nice thing about this method is that you don't need to store any probability tables; you just start the encoder and decoder in a context where all values are equally probable, then you just let them go and adapt. Arithmetic coders are ideal for adaptive modeling, which is one reason why people like arithmetic coders so much.

Unfortunately, in a high-performance networked game, adaptive modeling is not as straightforward as it is for a file compressor. Because the probability tables are implicit, the decoder needs to see the entire stream transmitted by the encoder. But in a networked game, we need to drop network messages or process them out of order. An adaptive decoder could not do this, as its probability model would fall out of synch with the encoder's, causing it to produce garbage.

Next month, we'll look at a scheme for adaptive modeling in a client/server environment. But you may decide that the necessary complication is not worthwhile; if so, a static probability

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model will still work for you. And thus, one of the primary purposes of this month's sample code is to provide a simple example of a static modeler.

Last month's encoder used an integer divide once per packed value to compute the new coding interval. This month's code uses a bit shift instead, so it's faster in that sense. Because we're multiplying probabilities, and those probabilities are necessarily approximate (because we must fit them into a piece of a machine word), we can ensure that they're represented as fractions whose denominators are a known power of two. Rounding the probabilities this way does distort them a little bit, resulting in a loss of compression efficiency, but that loss is so small as to be unnoticeable.

Structured Data

Now I'll talk about some ways in which the data you really want to transmit will differ from the sample code.

Much real-game data will be hierarchical. For example, to represent a game entity, we may have one object class definition per entity type; if the server wants to tell the client about this entity, it must transmit all the fields of that class definition. Those fields might be { `type = WIZARD, position = (x, y, z), angle = 1.12, health = 73` }. If we transmit two entities to the client, we make a message that looks like: [`WIZARD, (x1, y1, z1), angle1, health1, BARBARIAN, (x2, y2, z2), angle2, health2`]. Modeling this data as a linear sequence would be a mistake, since it's unlikely that the value of `health1` is usefully correlated with the next value in the sequence, the entity type `BARBARIAN`.

But we may wish to draw correlations between parallel fields (members of a party traveling together are probably near each other and are probably facing nearly the same direction). And we may wish to draw correlations between certain data fields and certain other protocol messages. Consider a "Drink potion" protocol message. If a character has low health and high mana and he drinks a potion, chances are good it's a potion of healing and not a potion of mana. Or, perhaps characters located near a town are usually drinking potions of speed, so that they can quickly leave the safe area and get to the fighting; but characters located out near the fighting are usually drinking potions of health and mana, and almost no potions of speed.

Coherent Values

This talk of position correlations brings up an important issue. As discussed last year ("Packing Integers," The Inner Product, May 2002), positions are generally transmitted as tuples of integers. Suppose I am camping with a party, and we are moving about healing each other and keeping watch for monsters. My current X position is 4,155 out of 10,000. (This is just an example and is likely to be too low-resolution a position for use in a real game.) Since I'm milling about, my next X position is likely to be near 4,155, but it probably won't be 4,155 exactly. It might be 4,156. But a generalized data modeler, written in the way of file compressors, would treat 4,155 and 4,156 as unrelated "symbols." An adaptive modeler, upon seeing the 4,155, would increase the probability of 4,155 coming again in the data stream, but implicitly this decreases the probability of seeing 4,156, thus hurting compression if I am moving at all.

Because we move through space continuously, spatial values are correlated. There is a high correlation between 4,155 and 4,156, because those points are spatially nearby. Thus when transmitting an X coordinate of 4,155, an adaptive modeler should actually increase the subsequent probability of all X coordinates in the neighborhood, using a Gaussian centered at 4,155. Actually, we'd ideally want to intercorrelate X, Y, and Z, keeping the resulting probabilities in a 3D grid; this is expensive, though, and independent 1D tables for each coordinate are almost as good in practice. (However, the higher the number of dimensions we work in, the worse this approximation becomes, so be hesitant when using it for a high-dimensional model. This is related to the fact that as n grows, the unit sphere in n dimensions contains decreasing amounts of space compared to the unit cube.)

I call this type of data a "coherent" value. Another example of a coherent value is health; if you are at full health and you're being attacked, your health will probably go down gradually. It's much less likely to drop instantly from high health to 0 health.

As I mentioned earlier, good compression is all about making accurate predictions. Predicting the change of continuous values over time has a history in online games; it's often known as dead reckoning. So as it happens, we want good dead reckoning not only to fill in the gaps between network messages, but to help encode and decode those messages too.

Next month we'll look at a method of adaptive modeling designed to operate despite packet loss in a client/server environment. In the meantime, this month's sample code will get you used to the basics of data modeling.

FOR MORE INFORMATION

Khalid Sayood. *Introduction to Data Compression, 2nd Edition.* Academic Press, 2000.

Mark Nelson. "Arithmetic Coding + Statistical Modeling = Data Compression." *Dr. Dobb's Journal* (January–February 1991).

Ian Witten, Radford Neal, and John Clearly. "Arithmetic Coding for Data Compression." University of Calgary technical report 1986-238-12. (Also known as the CACM87 paper.)

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15 Things All Artists Should Know: Part 1

It barely seems like yesterday that I sent off my first Artist's View column to the good people at *Game Developer*. But in fact, it's been 20 months since my stewardship of this column began. And what a long strange trip it's been.

After much thought and deliberation, I have decided that the time has come to move on and hand the column over to whomever is crazy enough to take it. However, if you could pause from your celebrations for just a few minutes, I have some final things to say before I go.

Thinking about the most suitable way to end my tenure, I put together a summary of the 15 most useful things I have learned over my years in the game industry. They are presented this month and next in no particular order except numerical, with the hope that someone might be able to find something genuinely helpful among the meandering analogies.

15. All artists are telepathic. At some point many years ago, from a place deep within the game development community, this insidious rumor sprang to life. Growing in popularity over the years, especially among company owners, producers, and project leads, it became an accepted truth that all artists could read the minds of those who controlled the games they were working on.

The phrase "You need to make a futuristic military stronghold" soon became the sum total of all design input from above, and the artist-telepath was then required to use his or her powers to discern exactly what that meant: from the overall size right down to the color of the ceiling tiles. Some artists began to believe that they did indeed have the power of telepathy, but time after time discovered the harsh reality of their mistake as they were told, "No, that's not really what I had in mind."

Despite the most strenuous efforts of artists over the years, there are many in positions of control within a project who to this day find it difficult to understand that vague instructions will always lead to a specific end result, and that this end result has absolutely no chance whatsoever of replicating the image they have in their head.

While reworking content is always going to be part of the artist's job description, getting as many specifics pinned down in advance can help reduce the number of times that each item has to be revisited. This in turn increases productivity while simultaneously reducing the chance of an artist's brain exploding.

screenshot courtesy of id

atmosphere

14. Get the right light. High school art history classes bored me beyond my ability to express it adequately in words. I know that understanding the evolution of art can help artists find their own particular path to inspiration, but to be honest, once my art teacher opened the Black Book of Misery, which was imaginatively titled *Art Through the Ages*, it wasn't long before I found myself hallucinating about how easy it would be to end my suffering with the cunning use of two gallons of Quinacridone Red and a box of No. 2 pencils.

However, regardless of my teenage inability to be interested in anything that didn't revolve around me (my wife thinks that this is still the case), I do recall being taught that many artists over the centuries have spent time working in specific locations entirely because of the quality of light to be found there.

If you have done much work outdoors (sketching, painting, photography) you have doubtless felt the forceful hand of nature slapping you around by dictating how an entire scene will look with a simple shift in the lighting conditions.

HAYDEN DUVALL | *Hayden lives with his wife, Leah, and their four children, in Garland, Tex., where he works as an artist at 3DRealms. Contact Hayden at haydend@3drealms.com.*

In the world of high-end computer graphics, perhaps the biggest improvement in recent years (in terms of realism at least) has been the advancement of highly complex lighting systems that distribute light more accurately, moving away from the the arithmetic cleanliness of *Tron* to the plastic rendering of *Babylon 5*.

Likewise, real-time graphics have also advanced in the quality of lighting available, and just like in the great outdoors, a game's visuals can be made or broken by the quality with which the available lighting technology is implemented.

Having covered lighting before and as there are many sources to consult about success in this area, my point here is simply that a game's visual design must also include lighting design to maximize its appeal. Too often light is an afterthought or is simply a means of making the characters and scenery visible to the player. However, light is central to how a game world looks, and as technology allows us to achieve more in this direction, we need to take maximum advantage.

13. Know what you've got and what you've not. Have you ever wondered why Carl Lewis never competed in the 3,000 meter event? He was one of the greatest athletes ever: a supremely fit speed machine. But, unless I am greatly mistaken, he never competed internationally in the 3,000 meters, or for that matter, the pole vault.

As I sit in this chair having just eaten enough lemon cake to feed a family of 12, barely able to tie my own shoelaces without groaning like I was giving birth to a giraffe, I'm sure Carl Lewis could have run just about any distance he pleased and still have beaten me by an incredible margin. However, my inclusion in the British Olympic Team was unlikely. From Lewis's point of view, the class of athletes he would need to compete against would be somewhat higher, and so he restricted his participation to those events at which he excelled.

Sure, the lure of being great at everything has to seem inviting to some athletes, but even decathletes have their weak events. When you want to be the best, specialization is the route to success.

In game art, there are all sorts of platform limitations, engine limitations, software limitations, and design limitations restricting your imagination and creativity. However, you probably have a few areas in which your game is particularly strong, and so your task is to try to think, from as early in the design process as possible, what to push and what to avoid.

If your water is pathetic, keep it to a minimum. If your engine crumples and dies when faced with expansive areas of terrain, for the love of God, stay indoors. Designing the visuals to complement your technology is not a cop-out, it is just intelligent planning.

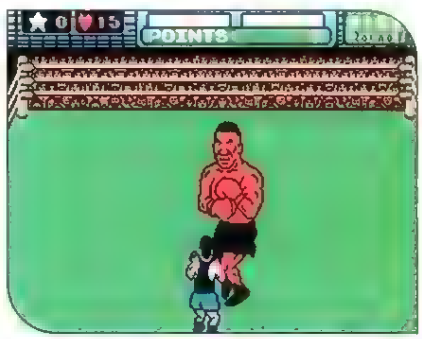
12. More real than real. Photo-real, hyper-real, ultra-real, take your pick (or make your own word up if you like): since the early days, the quest for more realistic graphics in games has formed a large part of an artist's job.

I vividly remember sitting in front of a TV screen in the early 1980s, marveling at how real I thought the world that had been created by an 8-bit computer seemed compared to the primitive blockiness of the Atari 2600.

In computer graphics terms, realism is a relative concept, or at least it has been until recently. As far as I can be objective about it, we are beginning to approach the very minimum threshold of what can be called genuinely realistic in real-time visuals. Certainly in a decade's time, we will look back on 2003 and see it as painfully low-tech and angular, but to the casual observer some of our current games are knocking on realism's door.

In the quest for photorealism, artists have long turned to the world around us for guidance. But like those involved in films have realized, we must learn when mere real-world material is not enough to provide the results we want.

As in film, the game medium ultimately affects how things appear on-screen. An image that travels through a camera and is then transported by film to the cinema screen represents an altered version of the original scene.



Mike Tyson's Punch-Out! A 1980s milestone in "photorealism" on home consoles. At the time, we thought that was pretty cool.

In games, photographic accuracy, such as physically realistic motion capture or lighting modeled faithfully on real-world readings, won't necessarily appear completely realistic to the player. The human eye reads the real world in an entirely different way than it does a computer screen or TV. The absence of genuine depth perception, the inherently flat and generally small amount of screen space available, as well as the restricted color palette and range of light levels all try to convince the player that what they see isn't real.

As a result, an artist has to learn to compensate for these obstacles by over-saturating colors when necessary, and upping contrast to bring out detail that would otherwise fade into obscurity. For example, the light that we think we see as white in the real world may need to be slightly blue on the screen. Animations that are entirely accurate may need to be exaggerated to help them make a convincing impact when they reach the player's brain.

11. The Death Star Principle. Based on the execution of the Death Star special effects for the original *Star Wars* trilogy, the Death Star Principle simply states: Only spend time putting detail where you need it.

It's sometimes hard as an artist to create something that is

plainly unfinished when examined as a single object or environment in isolation. But time and resources are rarely infinite, and artists must always focus their efforts in the areas that will have the most impact on the player.

10. The Power of One. This is not an assertion that you can single-handedly influence the course of your game by focusing all of your ninja powers on art, thus defeating the evil Publisher Hordes and freeing your game from its creative shackles. The Power of One is not about you at all, it's about the people to whom you report.

Each company has its own unique management culture. At one place it may feel as if you are toiling under the iron fist of Stalin with the chill wind of oppression blowing around your CPU. At another company, it may feel as if you're working for a 17-year-old whose parents have gone away for the weekend and have given him unrestricted use of their credit card. But whatever the situation, one of the most frustrating things you can encounter is the inability of many companies to decide who actually has the final say as to whether a particular art asset is acceptable or not.

Some companies (particularly those with overly complex management systems) have a whole batch of people in "executive" positions who all believe that their input and instructions need to be followed. From creative directors, art leads, internal and external producers, all the way to company accountants, marketing staff, investors, and the owner's mother-in-law, internal politics and the belief that seniority should automatically mean control in any area of the project can quite easily drive an artist to an early grave.

The easiest solution to this problem might be to go work for yourself, but as this is seldom practical (never less so than at present), how else can you improve things in this respect? Unfortunately, there is no easy answer. The more junior your position, the more likely you are to be affected by this kind of situation and the less chance you have of having any influence over it.

Pointing out this conflict of leadership will in some cases help get things straightened out so that they are less confusing. However, in certain circumstances, this will just exacerbate power struggles, placing you awkwardly at their center. One method that simplifies the situation is to request being assigned a specific person, whatever his or her title may be, to whom you report, and who has the authority to sign off on the work that you do. This needs to be one person and not a committee, and if a committee is deemed necessary, then just one of the people involved should be responsible for dealing directly with you.

This may seem to be a superficial solution that doesn't actually address the root of the problem. But assuming that you are not in a position to tell the management exactly how annoying their methods are, attempting to isolate yourself from all but one of them is a step in the right direction.

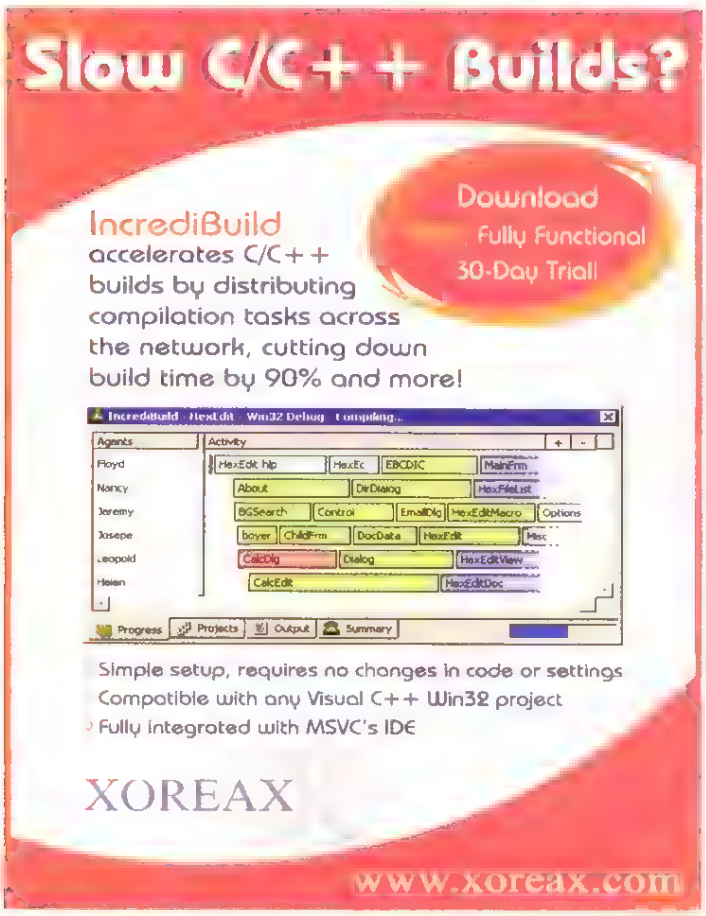
The real difference, however, has to be made by those who do in fact make the decisions. Be mindful of how things are organized and streamline the chain of command as much as you can.

9. I see triangles everywhere (OCTD). Do gastrointestinal surgeons walk down the street and visualize the intestines of the people they pass? Are architects compelled to analyze every building they see in terms of their design and fabrication techniques? The reason I wonder is that almost all the artists I know in the game industry have, at one time or another, caught themselves looking at a bridge and thinking, "I could do that in 150 polys."

Obsessive-Compulsive Triangulation Disorder (OCTD) is commonplace among 3D artists and can be a good indication that the infected person needs to get out more. Artist burnout is a real problem that can arise when either extremely long hours are maintained for unreasonable periods or work isn't varied enough to allow the artist a change of focus every so often.

Circumstances can sometimes dictate less-than-perfect working conditions, but it is certain that artists will not produce excellent work if they begin to show signs of this kind of fatigue. A sensible project lead will see that in the longer run, more can be achieved at a higher level of quality if the workload is organized to take fatigue and burnout into consideration.

Next month: The remaining eight things that all artists should know, and a final farewell.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"We've chosen you to make our game audio shine." Isn't that phone call one of life's most glorious moments? So glorious that sometimes we lose ourselves in the moment, the moment when we should be listening because the guy on the other end of phone says something that makes a little voice deep inside you scream, "Don't take this project!" Whether you're in-house, out-of-house, or working out of your own house, a promising project eventually will come up that will have a huge red flag draped all over it. Too often, however, we ignore this red flag until it's too late. To prepare us better, here are some warning signs to take heed of before accepting an offer.

That F-word. In the game world, we've adopted the term "foley" to refer to movement-related effects. Sadly, it has become one of the most abused terms in our industry and a real red flag catcher. If a producer calls up offering you the big gig, but says something like, "When the mega-laser gun fires the protoplasmic mega shot, we gotta have some really cool foley," watch out. When your contact starts talking gibberish, ask yourself whether he or she is making an accidental malapropism or covering up a lack of game audio knowledge by repeating buzzwords overheard elsewhere. Misused terminology could be a warning sign that your contact lacks an understanding of game audio. The confusion resulting from this ongoing miscommunication could pave a long, bumpy road.

RAM abuse. You've put hours of work into a complicated bid — a console title requiring tons of effects, ambiences, and yep, even foley. The phone rings. "We've looked at a bunch of talented sound shops, and, well, you're the one. Make us proud!" You want things to start off right, so while the party balloons are still floating, you pop the burning tech question: "Gee, with so many effects, I bet we're going to have some fun designing a dynamic caching system together with multiple primed streams and real-time sound mixing." Silence on the other end, then, "Look, this is really a simple game, and we're just going to downsample everything to 11K and shove it into RAM." Uh-oh. Technology drives great sound, so when a console game is made to use RAM like an audio CD, or when a PC game developer insists on using all MP3 compression at 96 kbps, you have to decide if you really want to make a game that you know isn't going to sound great.

> **The dreaded response: "Look, we've got a milestone coming up in about a week. We just need the sounds."**

Give me SFX. Back in the old days, before game developers got hip to post-production techniques, most game audio folks made sounds in the abstract, separated from the visuals, and then a programmer (usually in a bad mood) would pair up the audio with the visual event. It was guesswork. Sadly, some people are stuck in a time warp and still think we work this way; the worst incarnation of this problem is the infamous "Just make some sounds. Here's a list."

"But, what about the visual reference?" you protest. "You know, sync?" And then the dreaded response: "Look, we've got a milestone coming up in about a week. We just need the sounds."

The only result from this production method is failure. You can't make quality commercial entertainment by throwing together disparate parts and hoping they miraculously come together.

The art of diplomacy. Instead of running full speed for the door the minute you hear any of the preceding remarks, how can you turn things around to salvage the project (and your sanity)? When dealing with something as complex and specialized as sound effects production, you often have to be very understanding.

Let's say you're faced with a studio that honestly believes a mono ambience is good enough for their game. It's time to trade in your well worn audio cap for that diplomatic suit and tie hanging in the back of your closet. The three E's outline the basic steps to win them over: education, examples, and execution.

Education. Using the mono ambience situation as an example, you might (gently) explain that when one walks outside, sound is all around, that there is no single source for ambient sound, and therefore it can only be truly re-created in a game using surround.

Examples. Suggest a game or movie that utilizes ambient sound with great results. This gives people a tangible reference, which is worth more than words.

Execution. Now that you've persuaded them to see your point of view, you have to execute with two choices: prototyping or going straight to production. Either way, give them some impressive examples, create trust between the two of you, and move on to the next issue.

If it looks like you might be boarding a sinking ship, you've got to be polite and diplomatic, even in quitting. Create some good karma by passing the gig on to someone starting out in the business who needs the experience. This gives the publisher a quick fix and the other guy a great opportunity. You've done a good thing and saved your reputation in the process, just in time to look for a new gig and start avoiding red flags all over again.

ADAM LEVENSON | *Adam is the former audio director of Interplay Entertainment Corp., and is currently the audio director of Immersive Sound (www.immersive-sound.com). During his career Adam has worked on several award-winning titles.*

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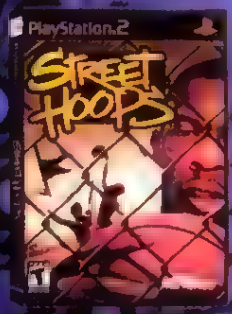

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Trumping Consistency

My June 2003 column, "The Hobgoblin of Little Minds," discussed how to handle consistency in game design. It's a tough problem, because the simplest rule, "Be Consistent," has so many obvious exceptions that it's of minimal use, although clearly some degree of consistency is beneficial. The question becomes, "How do I define and implement consistency, and how do I know when I have the right amount?"

An insight about it hit me while working on a client's design. In this particular game, players control astronauts performing experiments aboard a space station. We were stuck between wanting consistency or differences in the appearance of several different types of experiments, to either enhance or expand gameplay possibilities. Variety in gameplay — as well as fidelity to the way things work in the real world — felt more important than simple visual consistency, but I was curious to see if I could discover a governing rule.

A previously published rule ("AI Without Pain," January 2003) suggested, "When simulating a real system, use real-world formulas and cheat as little as is feasible." I think this rule extends to interface as well. A possible consistency rule is "Be Consistent with Gameplay Elements." But in our interactive medium, gameplay considerations should generally trump mere visuals, and so the question becomes, which gameplay elements are important here?

One possible answer comes from Stephen Triche, an IGDA member from Louisiana. He suggests trumping with a rule that limits excessive consistency when it renders the game too boring and predictable. That sounded familiar, and I realized that one of Hal Barwood's original rules from his 2001 GDC talk, "Four of the 400," was "Fight Player Fatigue." That rule is a perfect trump for consistency with both lower and upper limits.

Do these crates (from RATCHET & CLANK) contain bonuses bombs, or perhaps a few rules about consistency?

Too much consistency means the player will be fatigued through repetition, as when a character in a game repeats the same battle cry ad nauseam. But too little consistency fatigues the player through confusion and frustration. For example, it's frustrating when a character ordered to move from point A to point B picks a random pathway each time and sometimes arrives too late, while at other times wanders into dangerous traps.

I received some mail protesting my endorsement of Mark Cerny's suggestion about occasional random exploding crates, which I used to illustrate how lack of consistency can be useful. I don't mean to put words in Mark's mouth, so I'll take full responsibility to say that I like the idea but recognize why others may not. The safe solution would be to make exploding crates look slightly different, so the first such crate a player triggers may be a surprise, but subsequent dangerous crates can be detected and avoided. But "Fight Player Fatigue" is a good reason to have occasional exploding crates among many that merely provide bonuses.

This discussion raises the idea of considering rules about applying rules. It's one of the reasons that The 400 Project includes the concept of rules trumping each other, as in this case where a previous rule, "Fight Player Fatigue," acts as a sort of modifier for "Be Consistent with Gameplay Elements." Designer resistance to having exploding crates look just like the safe crates violates a rule I'll cover in a future column, "Play Fair."

Overall, it's important to structure games so the player who faces a setback says, "Shoot, I messed up," and not, "Dang, that stupid game cheated me!" (Readers are invited to substitute suitably stronger language to preserve suspension of disbelief.) Having unmarked exploding crates does violate the "Play Fair" rule, but by doing so implements the "Fight Player Fatigue" rule more thoroughly. I've heard a few developers balk at the idea of using rules to help them design games because rules feel restrictive, but a case like this illustrates how rules can set designers free to choose intelligently.

Ultimately, when rules conflict, it's up to the designer to choose among them. I prefer having a clear idea of the trade-offs instead of just a murky sense that one way may be better than another. To follow one rule consistently without considering possible trumps would be foolish — and if you're a regular reader of this column, you know what Emerson said about foolish consistency.

NOAH FALSTEIN | *Noah is a 23-year veteran of the game industry. His web site, , has a description of The 400 Project, the basis for these columns. Also at that site is a list of the game design rules collected so far, and tips on how to use them. You can e-mail Noah at noah@theinspiracy.com.*

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Much like the development sector, game publishing has changed irrevocably in recent years. Numerous mergers, closures, rebrandings, and restructurings have not only wiped away many of the big names of yesteryear but also sowed confusion about publishing's main players.

Yet understanding these changes and what makes each publisher distinctive is vital for those working in development. Knowing what makes a publisher tick can play a big role in getting the best out of your business relationships.

Awareness of a publisher's general attitude toward external development, its treatment of other developers, and what genres it concentrates on can be highly valuable when dealing with a publisher. Clearly, knowing who are the biggest publishers in the market is also pretty handy.

However, finding this information is no easy feat, so many developers go without, which is why *Game Developer* has put together this unique guide to the Top 20 publishers.

Over the next few pages, we profile the largest game publishers in the world, analyze the types of games they release, and explore their relationships with external development studios.

Among the information *Game Developer* compiled for this report are details on each publisher's reliance on existing IP, what formats it concentrates on, and how much use it makes of external developers. On top of this, we reveal the results of an exclusive poll finding out how developers really felt about the publishers with whom they worked.

We hope this report will prove a useful resource for developers and provide new insights into the workings of the world's leading publishers.

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20. MIDWAY GAMES

HEADQUARTERS Chicago, IL
FOUNDED 1988
CEO David Zucker
REVENUE (YE 12.31.02) $190.4m (excludes coin-op games)
EMPLOYEES 345 developers
WEB SITE www.midway.com
STUDIOS U.S.A. (Chicago, IL; San Diego, CA)

One of the grandfathers of gaming, Midway Games made its name in the arcades with a string of coin-op hits. However, in June 2001, Midway abandoned the declining arcade business to concentrate on developing games for the console and handheld markets.

Revivals of back catalogue games form a large part of Midway's output, although a third of its 2002 releases were original titles. External studios are responsible for half of Midway's output. Action and sports games form 95 percent of Midway's releases.

During 2002 Midway published a number of ports based on its final batch of coin-op games. As time rolls on, this side of their publishing activities is also bound to disappear.

TOP 5 PUBLISHERS BY OVERALL DEVELOPER RATING*

1. Atari	10/10
2. Activision	9.67/10
3. Take-Two	9/10
4. Ubi Soft	8.25/10
5. Capcom	7/10
5. Electronic Arts	7/10
5. Sony	7/10
5. THQ	7/10

*Among available data

19. EIDOS INTERACTIVE

HEADQUARTERS London, U.K.
FOUNDED 1990
CEO Michael McGarvey
REVENUE (4/1.01 TO 6.30.02) $197.4m
EMPLOYEES 200 developers
WEB SITE www.eidos.com
OTHER LABELS Fresh Games, Proein
STUDIOS U.K. (Core Design - Derby; London), U.S.A. (Crystal Dynamics - Palo Alto, CA; Ion Storm - Austin, TX)

Boosted by a one-off 15-month accounting period, Eidos, the British publisher best known for TOMB RAIDER, just manages to nudge ahead of Midway in our Top 20. However, it's doubtful it would have done so in a normal 12-month accounting year.

Despite having had a bumpy ride on the stock markets since its Lara-fuelled heights, Eidos is one of the Top 20's biggest investors in original games, with just over half its releases being new IPs (second only to Microsoft). In comparison, licensed games make up a mere 5 percent of the firm's output.

Around 60 percent of Eidos's games are externally developed. The remainder originates from the publisher's four internal teams, three of which have retained their pre-Eidos identity and are semi-autonomous.

Although Eidos began life devising video compression software before entering game publishing in 1995, it is now purely a game company. The firm also operates the Fresh Games label (dedicated to releasing Japan-centric titles in the West) and owns 75 percent of Spanish game publisher Proein.

18. KOEI

HEADQUARTERS Yokohama, Japan
FOUNDED 1978
CEO Keiko Erikawa
REVENUE (YE 3.31.03) $224.1m (estimated games only)
EMPLOYEES 447
WEB SITE www.koei.co.jp
OTHER LABELS Ergosoft
STUDIOS Canada (Toronto), China (Beijing; Tienjing), Japan (Yokohama), Singapore

It may lack the profile and output of its Top 20 peers, but Japanese publisher Koei has still managed to push its way into our rankings on the back of a handful of what many would label as niche titles.

The firm's success is largely due to its range of strategy games (mostly based on Chinese and Japanese history) and its horse-racing series, WINNING POST. Strategy games accounted for half of the eight titles it launched last year (the lowest amount for any Top 20 publisher).

Koei started life in 1978 as a producer of business software before entering game publishing in 1981. The business software division (Ergosoft) still exists but now makes up a tiny proportion of the company's activities. In addition to its game publishing and distribution operations, Koei has a media division producing strategy guides and audio CD spin-offs from its games.

Traditionally the firm's success was limited mainly to Japan, but in recent years Koei has attempted to broaden its horizons, expanding its overseas operations and the scope of its output with titles such as the rhythm action game GITAROO MAN. Despite such changes, Koei remains the only Top 20 publisher that develops all its games in house.

Our estimated revenues for all of Koei's divisions except for Ergosoft.

17. ACCLAIM

HEADQUARTERS Glen Cove, NY
FOUNDED 1987
CEO Rodney Cousens
REVENUE (YE 3.31.02) $268.7m
EMPLOYEES 512
WEB SITE www.acclaim.com
OTHER LABELS Acclaim Max Sports, Acclaim Sports, AKA Acclaim
STUDIOS U.K. (Cheltenham; Manchester); U.S.A. (Austin, TX; Cincinnati, OH; Glen Cove, NY)

With a hefty bout of cost-cutting currently in progress, Acclaim is having a rough time with share price tumbles and boardlevel changes to boot. The firm, a publisher of console and handheld games, relies on its range of sports titles for most of its income, and these comprise 65 percent of Acclaim's roster, the highest percentage of any Top 20 publisher. Sequels are also a fundamental part of Acclaim's offerings, accounting for 74 percent of releases.

External studios develop in excess of 65 percent of Acclaim's products, and with plans to cut back internal staff there is a possibility that this figure could rise. But external studios seem rather less than impressed by their experiences with Acclaim, with producer quality and milestone payment efficiency scoring a poor 2 out of 10 in our developer survey. The survey also found that Acclaim takes a hands-on role in the development process, scoring 7 out of 10 on this front.

Acclaim publishes its games under several sub-labels, including Acclaim Sports, Acclaim Max Sports and AKA Acclaim. Acclaim Publishing produces strategy guides for both Acclaim and other publishers' games.

16. NAMCO

HEADQUARTERS Tokyo, Japan
FOUNDED 1955
CEO Kyushiro Takagi
REVENUE (YE 3.3[illegible]) $359.7m (home games only)
EMPLOYEES 2,225
WEB SITE www.namco.com
STUDIOS Japan (Monolith Soft - Tokyo; Tokyo)

While amusement arcades continue to play a significant role in Namco's operations, home games are its most profitable division. Namco also views the division as having the greatest room for growth out of all its businesses and as such is working to increase its publishing activities.

Licenses make up less than 5 percent of Namco's output but games based around existing IPs account for 68 percent (down from a massive 87.5 percent reliance the year before).

The firm publishes console and handheld titles only. Externally developed games made up fewer than 4 percent of Namco's releases last year, although the levels have been higher in previous years.

Beyond home videogames, Namco produces coin-op games and runs amusement arcades and parks. Further business interests include hotels, movie special effects, music, web sites, and the Italian Tomato restaurant chain in Japan.

TOP 5 PUBLISHERS BY PERCENTAGE ORIGINAL TITLES

1. Microsoft	57.7%
2. Eidos	52.6%
3. Sony	45.5%
4. Take-Two	40.9%
5. Koei	37.5%

15. BANDAI

HEADQUARTERS Tokyo, Japan
FOUNDED 1950
CEO Takeo Takasa
REVENUE (YE 3.31.03) $372.6m (forecast games only)
EMPLOYEES 844
WEB SITE www.bandai.co.jp
OTHER LABELS Banpresto
STUDIOS Japan (Banpresoft - Tokyo; Bec - Tokyo; Tokyo)

The game arm of the Japanese toy and media giant Bandai has established a name for itself in game publishing, despite failing to loosen Nintendo's grip on the handheld market with its Wonderswan line of handhelds.

While still supportive of the Wonderswan consoles, the game-publishing wing is mainly focused on producing titles for the Playstation and Playstation 2. Most of the firm's releases are based on Bandai properties or other well-known franchises, which make up nearly 61 percent of the firm's games. External teams were responsible for just over a quarter of its games.

Bandai as a whole is involved in a huge range of markets, from car parts and coin-op machines to toys and TV cartoons. As a breakdown of earnings from its home games division was not available at the time of going to press, the revenue figure given here is Bandai's own forecast for the division's earnings.

TOP 20 PUBLISHERS

	Publisher	Revenue ($millions)	Titles	Releases	External Teams	Internal Size	Licensed IP	Sequels	Original IP	Producer Score	Milestone Score	Marketing Score	Involvement Score
1	Electronic Arts	2482.2	43	103	39.81%	4000	51.16%	60.47%	16.28%	8	8	7	8
2	Sony Computer Ent.	2180.5e	44	44	45.45%	1800	18.18%	45.45%	45.45%	5.5	8	5	2.5
3	Nintendo	2128.5	28	28	46.43%	1000e	3.57%	64.27%	35.71%	n/a	n/a	n/a	n/a
4	Activision	864.1	22	45	71.11%	612	63.63%	54.55%	13.64%	8.7	10	8	5
5	Vivendi Universal	832.5	54	79	50.90%	2000	51.85%	48.15%	11.11%	8	4	2	3
6	Take-Two	793.9	22	25	82.61%	939	9.09%	50.00%	40.91%	10	4	4	3
7	Atari	761.9	58	78	74.19%	1981	53.45%	46.55%	22.41%	10	10	6	6
8	Konami	740.2	64	87	6.90%	4313	21.88%	78.13%	21.88%	n/a	n/a	n/a	n/a
9	Microsoft Game Studios	614.4e	26	27	65.38%	800	23.08%	30.77%	57.69%	6	10	6	7
10	Sega	563.6	49	65	27.69%	1100e	18.37%	75.51%	18.37%	n/a	n/a	n/a	n/a
11	Square Enix	526.6e	25	27	24.00%	1097	16.00%	52.00%	36.00%	n/a	n/a	n/a	n/a
12	Ubi Soft	493.8	44	68	48.53%	1260	45.45%	47.73%	18.18%	7.5	10	7	3.75
13	THQ	480.5	47	72	62.73%	714	59.57%	38.30%	25.53%	7.6	8	6.4	3.8
14	Capcom	407.3	48	55	23.64%	800	25.00%	68.75%	18.75%	8	5	4	1
15	Bandai	372.6f	23	23	26.09%	844	60.87%	65.22%	26.09%	n/a	n/a	n/a	n/a
16	Namco	359.7	22	26	3.85%	2225	4.55%	68.18%	31.82%	n/a	n/a	n/a	n/a
17	Acclaim	268.7	23	42	66.66%	512	34.78%	73.91%	21.74%	2	2	4	7
18	Koei	224.1e	8	9	0.00%	447	12.50%	62.50%	37.50%	n/a	n/a	n/a	n/a
19	Eidos	197.4	19	27	63.16%	200	5.26%	42.11%	52.63%	8	10	2	6
20	Midway	190.4	18	50	50.00%	345	38.80%	44.40%	33.30%	n/a	n/a	n/a	n/a

An e denotes our estimated figures for their games division
An f denotes a figure forecast by the publisher itself
External teams – The percentage of releases developed externally
Internal size – Number of development staff
Producer Score – Average rating (out of 10) given by external studios of the publisher's producers. A 10 score is the best.
Milestone Score – Average rating (out of 10) given by external studios of the promptness of the publisher's milestone payments. A 10 score is the most prompt.
Marketing Score – Average rating (out of 10) given by external studios of the publisher's marketing efforts. A 10 score is the best.
Involvement Score – Average rating (out of 10) given by external studios on the level of publisher involvement in external projects. A 10 score means heavily involved, 1 is completely hands-off.
Overall Score – Average rating (out of 10) given by external studios on their overall experience of working with the publisher.
Main Format – The format the publisher releases the most games on.
RPG/Sports & Racing/Action/Simulation/Strategy – Percentage of titles that fall into these categories.
Puzzle & Misc. – Titles that do not fit the above definitions.
Children's – Games aimed purely at the children's market.
Consoles/Handhelds/Computers – Percentage of releases by a publisher for a particular type of system.

14. CAPCOM

HEADQUARTERS Osaka, Japan
FOUNDED 1979
CEO Kenzo Tsujimoto
REVENUE (YE 3.31.03) $407.3m (excl. arcade divisions)
EMPLOYEES 800 developers
WEB SITE www.capcom.com
STUDIOS Japan (Osaka); South Korea (Seoul); U.S.A. (Sunnyvale, CA)

Despite the underperformance of several of its big titles last year, Capcom remains a major force in game publishing. The firm relies heavily on sequels, with 69 percent of its titles being based on existing IP, notably RESIDENT EVIL. Licensed IP plays a much smaller role, accounting for 25 per cent of its games, while original games make up just 19 per cent of releases.

Action titles dominate the Capcom range, with 69 percent of its games falling into this category, the highest percentage for any publisher in the Top 20. Just short of 24 percent of Capcom games are developed externally. Capcom also plays external developer on occasion, notably creating Game Boy Color incarnations of ZELDA for Nintendo.

Capcom still maintains a presence in the arcade industry although the sector's long-term decline makes it an increasingly less important part of the business. The firm's Japanese arm also dabbled in board games last year with some success.

13. THQ

HEADQUARTERS Calabasas Hills, CA
FOUNDED 1989
CEO Brian Farrell
REVENUE (YE 3.31.03) $480.5m
EMPLOYEES 714
WEB SITE www.thq.com
OTHER LABELS THQ Wireless, ValuSoft
STUDIOS U.K. (Woking); U.S.A. (Calabasas Hills, CA; Cranky Pants – Kirkland, WA; Genetic Anomalies – Cambridge, MA; Grass Valley, CA; Heavy Iron – Culver City, CA; Helixe – Lexington, MA; Outrage Games – Ann Arbor, MI; Pacific Coast P&L – Santa Clara, CA; Rainbow Studios – Phoenix, AZ; ValuSoft – Waconia, MN; Volition – Champaign, IL)

Although a significant chunk of its games are pitched at the children's and budget markets, THQ has built itself into one of the world's biggest publishers.

Around 62 percent of THQ's titles are developed externally, although it has, primarily through acquisitions, created a robust internal development function comprising 11 U.S. studios and one U.K. studio.

THQ's releases tend to be based on licenses (60 percent) many of which are based on children's cartoon characters from Nickelodeon. Original products account for a quarter of the firm's output.

Alongside its clutch of studios, THQ also owns budget game publisher ValuSoft and has created THQ Wireless, a division dedicated to mobile gaming.

12. UBI SOFT

HEADQUARTERS Paris, France
FOUNDED 1986
CEO Yves Guillemot
REVENUE (YE 3.31.03) $493.8m
EMPLOYEES 1,260 developers
WEB SITE www.ubi.com
OTHER LABELS Blue Byte, Red Storm, SSI
STUDIOS Australia (Sydney); Canada (Montreal); China (Shanghai); Denmark (Copenhagen); France (Paris); Germany (Blue Byte – Mülheim; Dusseldorf); Italy (Milan); Japan (Tokyo); Morocco (Casablanca); Romania (Bucharest); Spain (Barcelona); U.K. (Oxford); U.S.A. (Red Storm – Morrisville, NC)

When it comes to internal development, few publishers can boast such a worldly presence as Ubi Soft, which seems to have a team in every corner of the globe.

Despite such a large internal development function the firm still uses external studios for more than 48 percent of its releases. Studios who have worked with Ubi Soft are positive about the experience, giving producer quality and milestone payments respective ratings of 7.5 and 10 out of 10. Ubi Soft also takes a backseat in the development process, with developers rating the publisher's level of involvement as 3.75 out of 10. Just under a fifth of Ubi Soft's games are original releases and 45 percent are based on licenses. Nearly 48 percent of titles are sequels to previous games.

The firm is purely a game publisher and owns a number of sub-labels via acquisitions, namely Blue Byte, Red Storm, and SSI (which is active as a label but not as a studio).

Overall Score	Main Format	RPG	Sports & Racing	Action	Simulation	Strategy	Puzzle & Misc	Children's	Consoles	Handhelds	Computers (PC/MAC)
-	PC, PS2 (each 24.27%)	11.63%	46.51%	20.93%	0.00%	6.98%	0.00%	13.95%	64.08%	10.68%	25.24%
7	PS2 (81.82%)	18.18%	22.73%	31.82%	4.55%	0.00%	13.64%	9.09%	97.73%	0.00%	2.27%
n/a	GBA (50.00%)	21.43%	17.86%	25.00%	0.00%	10.71%	21.43%	0.00%	39.28%	60.71%	0.00%
9.67	PS2 (26.67%)	4.55%	31.82%	45.45%	0.00%	9.09%	0.00%	9.09%	68.89%	22.22%	8.89%
3	PC (43.04%)	1.85%	3.70%	33.33%	0.00%	11.11%	7.40%	42.59%	25.31%	13.93%	60.76%
9	PC (40.00%)	0.00%	9.09%	59.09%	0.00%	27.27%	4.55%	0.00%	56.00%	4.00%	40.00%
10	PC (46.15%)	1.72%	31.03%	31.03%	0.00%	3.45%	10.34%	22.41%	33.32%	14.11%	52.57%
n/a	PS2 (36.78%)	4.69%	32.81%	29.69%	0.00%	0.00%	32.81%	0.00%	66.66%	25.29%	8.05%
6	Xbox (55.56%)	11.54%	26.92%	26.92%	7.69%	11.54%	15.38%	0.00%	55.56%	0.00%	44.44%
n/a	PS2 (32.31%)	10.20%	48.98%	28.57%	0.00%	0.00%	12.24%	0.00%	83.08%	12.31%	4.62%
n/a	PS2 (68.00%)	48.00%	20.00%	0.00%	0.00%	12.00%	16.00%	0.00%	72.00%	18.51%	16.00%
8.25	PC (27.94%)	6.82%	22.73%	22.73%	2.27%	13.64%	18.18%	13.64%	51.47%	20.59%	27.94%
7	PC/GBA (each 29.17%)	4.26%	2.55%	19.15%	0.00%	4.26%	6.38%	40.43%	40.28%	29.17%	30.55%
7	PS2 (38.18%)	8.33%	8.33%	68.75%	0.00%	2.08%	10.42%	2.08%	72.73%	21.82%	5.45%
n/a	PS2 (30.43%)	30.43%	13.04%	43.48%	0.00%	8.70%	4.35%	0.00%	73.91%	26.09%	0.00%
n/a	PS2 (42.31%)	22.73%	31.82%	31.82%	0.00%	0.00%	18.18%	0.00%	73.08%	26.93%	0.00%
2	PS2/GC (each 32.31%)	0.00%	65.22%	21.74%	0.00%	0.00%	13.04%	0.00%	78.57%	21.43%	0.00%
n/a	PS2 (77.77%)	12.50%	0.00%	25.00%	0.00%	50.00%	12.50%	0.00%	100.00%	0.00%	0.00%
n/a	PC (40.74%)	5.26%	21.05%	36.84%	0.00%	26.32%	10.53%	0.00%	55.56%	3.70%	40.74%
n/a	PS2 (32.00%)	5.56%	38.89%	55.56%	0.00%	0.00%	0.00%	0.00%	84.00%	16.00%	0.00%

11. SQUARE ENIX

HEADQUARTERS Tokyo, Japan
FOUNDED 2003
CEO Yoichi Wada
REVENUE (YE 3.31.04) $526.6m (estimate)
EMPLOYEES 1,097 developers
WEB SITE www.square-enix-usa.com
STUDIOS Osaka (Japan), Tokyo (Japan)

Square Enix was created on April 1, 2003, by the merger of Japanese publishers Enix (founded in 1975, and Square, formed in 1986. The result is a new publishing superpower with a sprawling distance of the Top 10.

Square's FINAL FANTASY and Enix's DRAGON QUEST games were the flagship products of the firms when they were separate, and the importance of role-playing titles for Square Enix is undeniable. In total, RPGs made up 48 percent of the firm's releases. In comparison, action titles do not feature in the firm's lineup at all.

The publisher's Japan-based internal teams provide the majority of games for the company, with the remaining 24 per cent of releases being produced by external Japanese studios.

The reliance on the DRAGON QUEST and FINAL FANTASY series means that more than 50 percent of Square Enix's releases are sequels or spin-offs, although a healthy 36 percent of titles are original games.

Game merchandising is the only activity beyond game development in which Square Enix is involved. Our estimated revenue combines the last results posted (both for the year ended March 31, 2003) by Square and Enix when they were separate businesses.

TOP 5 PUBLISHERS BY PERCENTAGE OF SEQUELS

1. Konami	78.1%
2. Sega	75.5%
3. Acclaim	73.9%
4. Capcom	68.8%
5. Namco	68.2%

10. SEGA

HEADQUARTERS Tokyo, Japan
FOUNDED 1952 (as Service Games)
PRESIDENT Hideki Sato
REVENUE (YE 3.31.03) $563.6m (home games software only)
EMPLOYEES 1,100
WEB SITE www.sega.com
OTHER LABELS Sega Mobile, Sega Sports
STUDIOS Japan (Amusement Vision, Hitmaker, Overworks, Sega AM-2, Smilebit, Sonicteam, United Game Artists, Wave Master, Wow Entertainment - all Tokyo); U.S.A. (Visual Concepts - San Rafael, CA)

The messy aftermath of the Dreamcast continues to haunt Sega despite the console's discontinuation in 2001. Sega's hopes of becoming the premier third party publisher have yet to be realized, and the procession of on-off merger partners and buyers that Sega has enterta ned in the past year has done little to help.

The changes are set to continue in the coming months as Sega sets about overhauling its internal development studios. Although details were thin on the ground as the Top 20 went to press, Sega intends to shut down four studios and create two new ones.

Sega's various internal studios handle 72 percent of the firm's games. Although internal teams dominate the release schedule, Sega bucks the trend among Japanese publishers of primarily using Japanese studios, hiring North American and European developers regularly.

Sequels dominate Sega's releases (75.5 percent), although licenses only form 18 percent of its products (equal to the amount of original products). Sports and racing games play a major role in Sega's business, taking up 49 percent of its output.

As well as its Sega Sports label, the firm has also created a mobile games division, Sega Mobile. Outside the consumer game market, Sega continues to be a major force in the arcade business, both as a coin-op manufacturer and operator of arcades. More recently, some of the firm's internal studios have also begun developing games for other publishers, notably Nintendo.

9. MICROSOFT GAME STUDIOS

HEADQUARTERS Redmond, WA
FOUNDED 1975
VP GAMES PUBLISHING Ed Fries
REVENUE (YE 6.30.02) $614.4m (est. game-only revenue)
EMPLOYEES 800 developers
WEB SITE www.microsoft.com
STUDIOS U.K. (Rare - Tywcross); U.S.A. (Ensemble - Dallas, TX; Redmond, WA)

Pinning down the size of Microsoft's game-publishing arm is not an easy task. Before Xbox was put in the newly created Home and Entertainment division, the company combined figures for Xbox hardware sales with games sales and also included revenues from the MSN network.

As a result we've estimated not only how much of the figure came from MSN but also how much came from Xbox hardware sales. However, we've been unable to take account of the effect of Xbox accessory sales and royalties from third party games, so these may be included in our estimate.

Microsoft Game Studios publishes both PC and Xbox titles. The launch of the Xbox altered Microsoft's game publishing approach significantly, and 55 percent of its output is now for the console, despite the Xbox launch occurring part way through the accounting period in question.

Nearly 58 percent of Microsoft's titles are original games, the highest amount of any Top 20 publisher, although this might be due to its desire to build up a range of exclusive IPs for the Xbox. Licenses and sequels were poor relations, clocking up 23 and 31 percent of Microsoft's games, respectively. Thanks to the MICROSOFT TRAIN SIMULATOR and MICROSOFT FLIGHT SIMULATOR range on PC, Microsoft is the biggest publisher of simulations in the Top 20.

While the purchase of Ensemble Studios and Rare has bolstered Microsoft's internal development power, about 64 percent of Microsoft's games are by external studios.

For external studios, Microsoft is nothing if not a reliable paymaster, scoring a perfect 10 when it comes to paying milestones on-time. But in other areas it does less well, with a 6 for producer quality and its marketing efforts.

8. KONAMI

HEADQUARTERS: Tokyo, Japan
FOUNDED: 1969
CEO: Kagenasa Kozuki
REVENUE (YE 3/31/03): $740.2m
EMPLOYEES: 4,313
WEB SITE: www.konami.com
STUDIOS: Japan (Tokyo, Osaka); U.S.A. (Hawaii; Redwood City, CA)

When it comes to the sheer number of titles, Konami wins hands-down. The firm published 64 titles in its last accounting year, six more than its nearest rival, Atari.

This prolific output is achieved almost entirely by Konami's own development studios or by semi-independent studios such as Mobile 21 (50 percent owned by Konami; Nintendo owns the other half). The result is that independent studios produce just 7 percent of Konami's titles.

Konami's output covers a good spread of genres, although its wide range of sports and racing titles are the largest slice (33 percent). Konami publishes titles for all the leading platforms, although home console games form the bulk of its releases (67 percent) followed by handheld consoles (25 percent).

Sequels accounted for 78 percent of Konami's games last year, the highest level for any Top 20 publisher. Original games made up 22 percent of releases.

Konami also has business interests in coin-op games, toys, and card games (notably Yu-Gi-Oh!). It also runs a chain of health and fitness clubs in Japan.

7. ATARI

HEADQUARTERS: Lyon, France
FOUNDED: 1983
CEO: Bruno Bonnell
REVENUE (YE 6/30/02): $761.9m
EMPLOYEES: 1,981
WEB SITE: www.atari.com
STUDIOS: Australia (Melbourne House – Melbourne); Canada (Montreal); France (Eden Studios – Lyon); U.K. (London; Reflections – Newcastle-upon-Tyne); U.S.A. (Shiny – Aliso Viejo, CA; Beverly, MA; Humongous – Bothell, WA; Paradigm – Carrollton, TX; Legend – Chantilly, VA; Hunt Valley, MD; Plymouth, MN; Santa Monica, CA)

Built on the back of a complex and lengthy series of acquisitions, the publisher formerly known as Infogrames has established itself as one of the industry's biggest players. In recent years the company has undergone a barrage of buy-outs, studio closures (most recently one in Sheffield, U.K.), and a rebranding exercise to become Atari.

Despite Atari's hefty collection of studios, 74 percent of its games are still developed externally. Releases are biased toward PC games, which account for 46 percent of titles published, primarily due to Atari's strong edutainment arm.

Original games make up around 22 percent of Atari's releases, while games based on licenses make up a further 54 percent.

When it comes to relations with external studios, Atari is viewed as one of the best, with developers rating the publisher a full 10 out of 10 for producer quality and milestone payment efficiency.

6. TAKE-TWO

HEADQUARTERS: New York, NY
FOUNDED: 1993
CEO: Jeffrey Lapin
REVENUE (YE 10/31/02): $794.0m
EMPLOYEES: 939 (last reported)
WEB SITE: www.take2games.com
OTHER LABELS: Gathering, Global Star, Gotham Games, Rockstar, Talonsoft
STUDIOS: Austria (Rockstar Vienna); Canada (Global Star – Mississauga, ON; Rockstar Vancouver); UK (Rockstar North – Edinburgh); U.S.A. (Gathering – Austin, TX; Talonsoft – Baltimore, MD; Pop Top – Fenton, MO; Rockstar San Diego)

Propelled by the huge success of the GRAND THEFT AUTO series, Take-Two have quickly climbed to the upper reaches of the Top 20 with annual revenues almost doubling in the wake of GRAND THEFT AUTO 3.

But while a hefty chunk of Take-Two's income may result from the internally developed GRAND THEFT AUTO games, external studios do feature heavily in the firm's activities. In its fiscal 2002, just short of 83 percent of its games were developed externally, the biggest share of any Top 20 publisher.

Take-Two concentrates on action and sports games, which together account for 86 percent of the publisher's releases. The firm concentrates on console and PC titles, with handheld releases being few and far between.

Roughly half of Take-Two's products are sequels, with original games accounting for a further 41 percent of releases. Licenses make up just 10 percent of releases.

Take-Two's reputation with external studios is sterling, and its producers scored an average rating of 10 out of 10, the highest of any Top 20 publisher. Milestone payment efficiency was highly rated at 8. Take-Two's involvement in the creative process was seen as relatively light, scoring a 3 out of 10.

There is a high degree of overlap between Take-Two's five labels, but generally speaking Gathering concentrates on PC titles, Global Star publishes budget PC games and PDA titles, Gotham Games publishes titles aimed at all ages, while Rockstar Games aims at older players. Finally, TalonSoft publishes PC strategy, simulation, and action games.

The company also owns Global ProBiz, a spinoff from Global Star that publishes business utility software, and peripheral manufacturer Joytech.

TOP 5 USERS OF EXTERNAL STUDIOS

1. Take-Two	82.6%
2. Atari	74.2%
3. Activision	71.1%
4. Acclaim	66.7%
5. Microsoft	65.4%

TOP 5 PUBLISHERS OF CHILDREN'S GAMES

1. Vivendi Universal	42.6%
2. THQ	40.4%
3. Atari	22.4%
4. Electronic Arts	13.9%
5. Ubi Soft	13.6%

5. VIVENDI UNIVERSAL GAMES

HEADQUARTERS: New York, NY
FOUNDED: Became Vivendi Universal in 2000 although the business dates back to the 1980s
CEO: Ken Cron
REVENUE (YE 12/31/02): $832.5m
EMPLOYEES: 2,000
WEB SITE: www.vugames.com
LABELS: Black Label Games, Blizzard, Fox Interactive, KnowledgeAdventure, NDA Productions, Sierra, Universal Interactive
STUDIOS: France (Coktel – Paris); Sweden (Massive Entertainment – Malmo); U.S.A. (Sierra – Bellevue, WA; Impressions – Cambridge, MA; Blizzard – Irvine, CA; Knowledge Adventure, Black Label Games, Universal Interactive – Los Angeles, CA; Blizzard North – San Mateo, CA; Papyrus – Watertown, MA)

Up for sale it may be, but the troubles of its parent company don't distract from the powerful position Vivendi Universal Games has in the publishing market.

A large part of the publisher's success is due to its strength in the edutainment sector, where it bears the KnowledgeAdventure label. Around 43 percent of Vivendi's titles are aimed at the children's market, the highest amount of any Top 20 publisher. As a result, computers (PC and Macintosh) are the platforms of choice at Vivendi, forming 61 percent of all releases. Consoles represent just 25 percent, the smallest for any Top 20 publisher.

Original games make up little of the publisher's releases (11 percent, to be precise, the lowest of any Top 20 publisher), the focus being firmly on licenses and sequels.

Approximately half of Vivendi's games are made externally, although relations with studios are patchy. The firm's producers score a healthy 8 out of 10, but its performance on milestone payments and marketing efforts is much weaker, respectively scoring 4 and 2. In fact, as a whole, external teams give Vivendi an overall score of only 3 out of 10.

TOP 5 PUBLISHERS BY NUMBER OF TITLES

1. Konami	64
2. Atari	58
3. Vivendi Universal	54
4. Sega	49
5. Capcom	48

4. ACTIVISION

HEADQUARTERS Santa Monica, CA
FOUNDED 1979
CEO Robert Kotick
REVENUE (YE 3/31/03) $864.1m
EMPLOYEES 612
WEB SITE www.activision.com
OTHER LABELS: Activision O2, Activision Value
STUDIOS U.K. (Slough); U.S.A (Gray Matter – Los Angeles, CA; Z-Axis – Hayward, CA; Luxoflux – Santa Monica, CA; Neversoft – Woodland Hills, CA; Raven – Madison, WI; Shaba Games – San Francisco, CA; Treyarch – Santa Monica, CA)

Since its formation by a bunch of rebel Atari programmers in 1979, Activision has been one of the top dogs in the industry (a brush with death in the early 1990s notwithstanding). Today much of Activision's success is due to the licensed games that account for 64 percent of its releases, the highest of any Top 20 publisher. In comparison, original products make up little of the publisher's output, forming a paltry 14 percent.

In terms of development Activision is a big user of external studios (71 percent of its releases). Home console games are the largest segment of Activision's products, accounting for 69 percent of its releases. Handhelds come next with a 22 per cent share, while computer titles form just 9 percent.

External studios report good relations with Activision, and its milestone payment record is a perfect 10 out of 10. Producer quality is good with an 8.7 rating, and its overall mark from developers is an impressive 9.7 out of 10.

Activision is solely involved in game publishing. Its Activision O2 label handles its alternative sports releases. Activision Value is its budget brand.

3. NINTENDO

HEADQUARTERS Kyoto, Japan
FOUNDED: 1933 (as Yamauchi Nintendo & Co., although its origins date back to the late 19th century) – entered coin-op game industry in 1963.
CEO Satoru Iwata
REVENUE (YE 3/31/03) $2,128.5m (game sales only)
EMPLOYEES 1,000
WEB SITE www.nintendo.com
STUDIOS Canada (Silicon Knights – Toronto); Japan (Intelligent Systems – Kyoto; Saru Brunei – Kyoto; Kyoto; Brownie Brown – Tokyo; NDCube – Tokyo); U.S.A. (Retro Studios – Austin, TX)

The Top 20's oldest company with roots dating back to the late 19th century, Nintendo proper first appeared in 1933 with the formation of Yamauchi Nintendo & Co. In 1963 the firm became Nintendo and entered the coin-op game industry.

Nintendo's products cut across all genres, and while it's reliant on the sequels and spin-offs of its big name titles (these form 64 percent of its releases), some 36 percent of its output is original products. In contrast, licenses barely register accounting for a mere 3.5 percent of Nintendo's titles.

Around 46 percent of Nintendo games are developed externally, but the firm tends to limit its use of outside studios to a select few. This external studio pool mainly consists of Japanese teams, although western teams have been getting more of a look in recently. Nintendo also tends to part-own a significant number of the external studios with which it works.

2. SONY COMPUTER ENTERTAINMENT

HEADQUARTERS Tokyo, Japan
FOUNDED 1993
CEO Ken Kutaragi
REVENUE (YE 3/31/03) $2,180.5m (estimate)
EMPLOYEES 1,800
LABELS SCEI, SCEA, SCEE
WEB SITE http://global.scei.co.jp
STUDIOS Japan (Contrail – Tokyo; Polyphony Digital – Tokyo; Zener Works – Tokyo; Tokyo); U.K. (Cambridge; Liverpool; London); U.S.A. (989 Sports/Studios – San Diego; Bend, OR; Foster City, CA; Salt Lake City, UT; Naughty Dog – Santa Monica, CA)

With 12 internal studios and a hefty 44 titles published in its last accounting year, it should come as little surprise that Sony Computer Entertainment is wedged firmly in the upper reaches of the Top 20.

We estimate Sony's revenues for game publishing (including income from third-party publisher royalties) stands at nearly $2.2 billion, using installed base figures for Playstation and Playstation 2 consoles in the year ended March 31, 2003, as the basis.

Sony's publishing output touches most genres but action and sports/racing games dominate, making up 32 and 22 percent of its output, respectively. Like Microsoft, Sony invests heavily in new IP (no doubt to bolster the number of exclusive Playstation games on the market), and in its last accounting period 45 percent of its games were original. Sequels also account for 45 percent of titles, while licensed products make up just 18 percent.

While Sony boasts sizeable internal development, it still turns to external studios for 45 percent of its releases. External developers report mixed experiences with Sony. Its producers score just 5.5 out of 10, while its milestone payments score 8 out of 10.

Structurally Sony Computer Entertainment consists of three divisions: SCEI (Japan and Asia), SCEA (America), and SCEE (Europe and Australia). Each division controls what it does and does not publish. A separate company, Sony Online Entertainment, handles Sony's online PC game titles such as EverQuest.

The forthcoming PSP handheld will doubtless make a big impact on Sony Computer Entertainment's future output.

1. ELECTRONIC ARTS

HEADQUARTERS. Redwood City, CA
FOUNDED 1982
CEO: Lawrence Probst
REVENUE (YE 3/31/03) $2,482.2m
EMPLOYEES: 4,000
WEB SITE www.ea.com
LABELS. EA Games, EA Sports, EA Sports Big, Pogo.com
STUDIOS: Australia (Melbourne); Canada (Vancouver); Japan (Tokyo); U.K. (Chertsey; Warrington); U.S.A. (Irvine, CA; Los Angeles, CA; Maitland, FL; Maxis – Walnut Creek, CA; Origin Systems – Austin, TX; Tiburon – Orlando, FL; Redwood City, CA; San Francisco, CA)

Was it only 20 years ago when EA was churning out their "We See Farther" ads? Having long eclipsed its rival third-party publishers (its revenues are almost three times that of Activision, the next biggest third-party publisher) EA now even overshadows Nintendo's and Sony's publishing operations.

In addition to having the biggest revenue, EA also lays claim to having the most releases (103 were published in its last financial year). Most of these are now handled by the firm's range of internal development studios, leaving external developers to produce 40 percent of EA's output.

Despite the internal studios' overshadowing external studios, relations with outside developers are good, with milestone payments and producer quality both rated 8 out of 10 by developers with experience in dealing with the publisher.

Licenses and sequels are a core element of EA's output. Licenses account for 51 percent of its games, while 60 per cent are sequels, spin-offs, or expansion packs. Original games make up a relatively low 16 percent.

Sports and racing games are EA's bread-and-butter genres, taking up 46.5 percent of its release schedule. EA concentrates on console releases primarily (64 percent of all titles), followed by PC titles (25 percent).

EA Games handles non-sports titles, while EA Sports and EA Sports Big handle sports output (the latter concentrates on arcade and alternative sports while the former leans towards simulation). The advertising-funded Pogo.com provides free online card, board, and puzzle titles.

METHODOLOGY

Publishers have been ranked by revenue from home game sales using figures from the last year-end accounts before April 1, 2003. Revenues that were not originally in U.S. dollars were converted using historical exchange rate data from the Federal Reserve. In some cases where publishers didn't make game-only income available, such revenue was estimated, and these instances are clearly indicated in the text.

When analyzing the games a publisher has released, the games examined were those published in the period the publisher's revenue figure covers. This data, along with most general company information, came from the publisher itself, however in several cases it was necessary to compile such information independently. Budget re-releases, compilations, and repackaged games have not been included. Mobile phone, coin-op, and interactive TV games have also been excluded.

The developer ratings are the sum rankings given anonymously by developers who have worked with the publisher.

In the text we have defined the following terms as follows: A "release" is a game for a particular format (so if a game appears on four formats it counts as four releases), whereas a "game" counts as a "title" regardless of how many formats it appears on (so a multi-format game counts as one title). A "sequel" is any game that uses an existing videogame IP. A "license" is any game that uses a non-videogame IP as its basis (including IPs owned by the publisher's parent company). An "internal studio" is one that is more than 50 percent owned by a publisher.

Every effort has been made to ensure the accuracy of the information contained within this article. However, we cannot guarantee its accuracy or completeness, and we will not accept liability for any direct, indirect, or consequential loss arising from its use.

Action!

Gathering Assets on Location Without Getting Crushed

ENTER THE MATRIX is a lot of things: an exciting project, a lucrative licensing opportunity, a new type of film-game production scenario. Through my professional lens, though, the project was a unique learning experience, another chapter in the big book of game producer know-how.

Larry and Andy Wachowski, the filmmakers and creators of *The Matrix* film trilogy, envisioned the game project as being truly complementary to the films. ENTER THE MATRIX wasn't simply a lunchbox tie-in deal — the game was placed right alongside the film production itself, with a level of collaboration previously unknown in either Hollywood or the gaming industry.

The arrangement required Shiny's team to rethink many issues, chief among them the fundamental need to gather crucial assets, digital and otherwise, in the midst of a whirlwind of a film production. All told, Shiny team members spent roughly 25 weeks on-location with the film production, gathering source material for the game.

The Wachowskis blazed a trail for how games can complement films, and this style of collaboration will, we hope, become the rule rather than the exception. More and more game developers will find themselves on film sets and at studios with three goals in mind: gathering the kinds of creative assets that will make a great game, keeping a lid on their budget, and doing it all while managing and preserving the all-important relationship with the film production.

With Shiny's lessons learned, there are several high-level points to share about entering the film world and bringing back the kinds of assets that will allow a game developer to create the best possible project with the least number of headaches.

Asset Acquisition and Control

Gathering and managing assets sounds like a producer's job, and it usually is, but understanding the process is useful for anyone in game development.

Know what you need and when you can get it. The first rule of gathering assets from a license holder, such as during a movie production, is that you can never go back and get more material. On location at the *Matrix* sequels, sets were constructed and demolished with lightning speed. Actors shot their scenes and left the production just as quickly.

Cost-saving opportunities came and went, and we were fortunate enough to capitalize on them due to collaboration in scheduling. You'd think that with a total film production time of well over a year, there would be plenty of time to gather assets. On the contrary, larger productions mean smaller windows of opportunity. Grab the assets while you can, because once the set is torn down and the actors go home, they're gone for good.

The second rule is that you must fully understand the scope of the game project and all of its needs. This may sound obvious, but in truth many developers don't do this early enough in production. In any license relationship, the licensor is not going to just offer you everything they have. You must first outline everything needed for the game and then ask for the right materials. The first step for asset gathering, then, is getting a complete understanding of the game's vision, with input from the designers, department leads, and individual team members. Identifying your asset needs is important, and so is talking to the people who will actually be working with the assets. The wrong angle on a digital picture can lead to hassles later. Don't waste time fixing something in Photoshop when you can capture it correctly the first time out.

Know what you don't need. On the other hand, you can't take the blanket approach either. Don't grab everything you see "just in case." One problem with this approach is that grabbing everything you think you might possibly need means you'll end up with an unwieldy amount of data, only some of which is useful. We snapped more than 25,000 digital photographs for ENTER THE MATRIX — in hindsight, a little excessive. Not only did we need additional network storage space, we wasted time making artists sift through thousands of images to find the gems they actually needed.

A second problem with going after everything you can get your hands on is that it simply takes too much time. In many cases, getting digital photos of the sets meant that set demolition plans were delayed. Motion capture work meant tying up an actor's time for a day, but some moves turned out to be unnecessary. The latter point is especially key because in some cases, the game publisher may bear the daily shooting costs of an actor working for the developer.

You'll need to work closely with the licensor's interactive department or production department. Not only will you have the best chance of being in the right place at the right time, but it also means significant cost savings. For ENTER THE MATRIX, motion capture shoots were scheduled alongside mocap shoots for the film, meaning the visual effects department and the game shared costs for stage construction, talent, striking the stage, and the like. Planning your needs on the game side is only half the battle — planning the methods of asset gathering with your licensor is a crucial cost-saving step.

STUART ROCH | *Stuart is the executive producer at Shiny Entertainment and has seen* The Matrix *enough times to get free passes to any show ending in "-Con." He can be contacted at sroch@shiny.com.*

Plan storage and access. Finally, you'll need a plan for asset control. Once you gather all these assets, where will they be stored? Who will have access to them? In the case of the *Matrix* production, secrecy and data security were extremely important. We had to strike a balance — providing access on a need-to-use basis without hampering someone's ability to do his job. A secure network location for all the data is the best bet, providing access rights to key team members as needed. Scan all hard-copy material and store the data in the same location as the digital assets.

Whatever your plan, make sure you have one. Storing data in willy-nilly fashion — some in filing cabinets, some in binders, some on portable hard drives, some on the network — is a nightmare scenario. A central, organized data repository (with regular backups) could be the difference between an invaluable resource and a complete waste of time.

Types of Assets to Gather

While the scope of your project will dictate the types of assets you should expect from your licensor, the list of assets you can hope to gather is surprisingly large. In the case of a film license, just about everything the audience sees is a valuable resource.

The most obvious assets are digital reference photographs of sets, props, and costumes, plus ADR recording, cyber-scans, and motion capture of the talent. But there's much more beyond the obvious, if you know to ask for it.

In preproduction or planning stages, acquiring storyboards and conceptual artwork can get your team inspired and off in the right general direction. Ask for construction blueprints of sets, AutoCAD files of upcoming production pieces, and early versions of the scripts.

Once you and your licensor are in full production, take some of the early assets you've already gathered and compare them to the final products. For example, compare costume sketches with fabric swatches for the production costumes. Set references can be contrasted with the final set of blueprints or lidar scans of the locations. This will also be the time you'll want to conduct any detailed photo sessions of sets of the actors, conduct motion capture if not already completed, and perform ADR sessions of any actors you'll need for the game.

Digital Photography

One of the most important types of assets you'll gather during the course of your project is digital reference photography. Digital pictures of sets, actors, props, vehicles, and other assets are one of the primary means for your artists to create game assets faithful to the source material.

Do it yourself. The first step here is being firm with your licensor that one of your team members needs to take the pictures. The licensor may prefer to provide a photographer (and it may sound like a reasonable suggestion), but there are two key problems with this arrangement.

First, while a third-party photographer may be an expert in photography, he or she is unlikely to understand fully the context in which the photographs will be used. Taking detailed reference photos for a game artist to work with is a completely different animal from taking general overview shots. The angle, lighting, context, and the shot selection itself can all mean the difference between something that's merely a good reference and something that's truly useful for an artist to implement in the game.

Another problem with using a third-party photographer is that it robs you of the ability to answer questions about the subject matter later. On ENTER THE MATRIX, there were count less times when an artist had questions about light levels, colors, and subject matter. Fortunately, we had producers and artists on-hand who could answer those questions, as they had actually taken the shots themselves.

Get ready for your close-ups. Don't neglect opportunities to capture the details of your shooting subject in addition to the overall shots. Overall set reference is useful, but your artists will also need shots of the little details, such as wall textures, close-ups of floor patterns, and subtle character nuances.

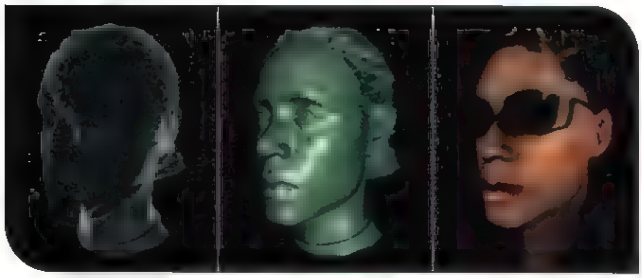
On one occasion while working on ENTER THE MATRIX, the film crew's first unit was resetting cameras for the next shot. At that point, the interactive producer said, "Go! Now's your chance to get what you need." While I felt silly taking close-up pictures of crates, piles of garbage, and rocks while the actors looked on, I couldn't give up the opportunity. Take advantage of any opportunity you have to gather assets, and don't be afraid to do the job you need to do to support your team back home. By the end of shooting, everyone on the *Matrix* crew understood why we were taking close-ups of doorknobs, and I think they even came to respect that we were trying to achieve a high level of continuity between the film and game.

Side-by-side comparison of Jada Pinkett-Smith's reference photo and her final in-game character Niobe

Make your references work for you. Getting useful reference photography could be an entire article itself, but there are two basic points that can help anyone set up a collection of valuable assets.

First, you don't need expensive equipment to be effective. For ENTER THE MATRIX, we used two 3.1 megapixel cameras and a 4.0 megapixel camera for important shoots, such as when we had sessions with primary film talent. Additionally, we used a video camera for overall continuity documentation. We could have spent more on equipment, but these cameras served us well. With smart purchases, you should supplement your camera package with a good macro lens for close-up photography; remote camera releases to reduce vibration; sturdy tripods, lights, and stands for character reference photos; lots of backup batteries; and a neutral screen background for shots of the talent. Price shouldn't be a big factor in your decisions, but opt for a complete and portable equipment package that can give you enough flexibility to handle the unexpected.

Second, when taking pictures of the primary talent, be respectful of the time they are giving you. Create a plan of what angles you need, what poses are necessary, and what costume configurations you need, and create a checklist for all of



Varying stages of Jada Pinkett-Smith's cyber-scan from original files to her completed Niobe character

this so you can get the shots you need quickly and efficiently. An actor's time is precious, and getting them in costume, hair, and makeup can be tricky, given their shooting schedules. Nothing is worse than spending time with an actor only to find out later that you forgot to take shots the designers or artists wanted. ("Uh, Jada, can we do another photo session so I can get a couple shots of your teeth?") No matter how personable the actor is, he or she is not going to be amused to hear that you need a second session because you didn't get it right the first time.

Cyber-scanning

You'll probably be in good hands with just about any firm you contract with to provide your scans, and you don't need to be a rocket scientist to work with them. But there are a few key basics to understand that will serve you well.

At the very least, you will need body scans of the actors, as well as head scans. Going a step further, consider getting scans of their hands, and performing body scans in both full costume and unitards. While the unitard scans capture the best information on each actor's physique, costume scans are also useful in illustrating how the fabric hangs on the actor and the rough proportions of different costume pieces.

As an aside, when doing cyberscans with actors in the unitards, try to be respectful of the situation they're in. Even though the sessions are interesting, resist the urge to have a bunch of guys from the development team in the trailer while the scans are being performed. The unitards leave little to the imagination, so make the talent as comfortable as possible with the process by keeping the personnel involved to a minimum.

Cyber-scanning provides instant feedback — the results are right there on the computer monitor. Obviously, the most important thing is for the actor to remain perfectly still during the scan, or else the subject will produce "waves" in the scan. Though the cyber-scan technicians are the best experts on what makes a good scan, speak up if you feel a second (or even third or fourth) scan is appropriate. The most you'll lose is another minute or so of the actor's time, which is well spent compared with not having all the scans you need. Remember, you can never go back and get more scans.

Finally, consider contracting with a cyber-scan company that offers a mobile rig. For ENTER THE MATRIX, cyber-scan equipment was driven to shooting locations in the U.S. and then shipped to Sydney, Australia, to scan actors not available on the U.S. shoot.

Having the equipment shipped to the film location, even if it's in another country, may seem excessive, but it may actually result in cost savings when you consider the expenses of bringing the actors to the equipment via first-class flights and five-star accommodations.

Motion Capture and Facial Capture

Motion capture is likely one of the most important assets on your list. Sessions can last as little as a week or as long as several months, depending on the level of detail required for the game project, but there are a few general things to consider overall.

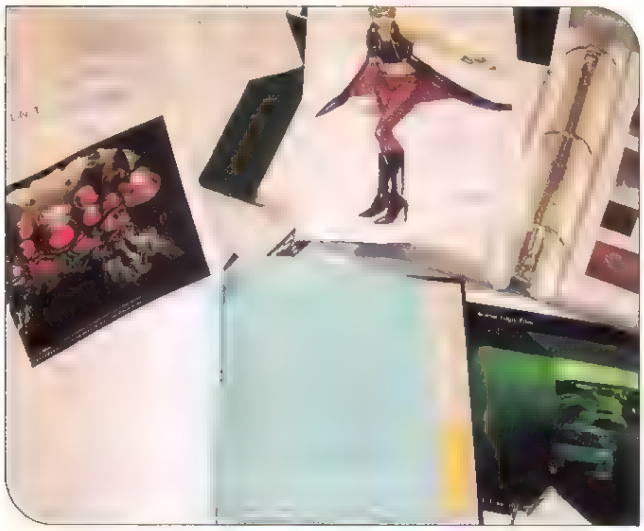
The first consideration is the technology you choose for your capture sessions. There are several choices for camera types, how many cameras will suffice, and what type of rig will be built to support the cameras. You will need to carefully screen the various contractors that specialize in motion capture and pick a partner that offers the best technology for your project and your budget. While the technology we used for ENTER THE MATRIX was cutting-edge at the time, it is probably already obsolete. Shiny held separate sessions for full-body capture and facial capture, but some technologies now allow for simultaneous capture of both.

Plan the costs carefully for your motion capture sessions. It's easy to figure out what the mocap sessions will cost from a high-level perspective, but are you also considering costs for prop construction, catering, and even renting director's chairs? Chances are that your initial bid will be much less than the out-the-door costs. Plan the budget carefully to avoid massive cost overages. It's always better to include all the details in your initial budgets that will be up for approval.

Careful budget planning is always useful, but it's especially important for film licenses, because there are potential cost-savings in coordinating with the film's visual effects department. Not every film will have visual effects work as extensive as *The Matrix*, but even small films may do some motion capture for their project, and if so, it may be a golden opportunity to discuss a partnership to save costs. If you can record the game mocap at the same time as the film's sessions, costs can be shared for the mocap rig, stage time, and talent.

Working out a cost-saving partnership with the film production will be attractive to your publisher. One downside, however, is that joint mocap sessions will probably have to be scheduled earlier than your animation team would normally plan to conduct their sessions.

As with the budget, planning is also crucial when generating your mocap shot list. In the case of ENTER THE MATRIX, our lead animator spent nearly nine months generating his final shot list. While the preparation involved may seem excessive,



Character sketches, renderings, photographs, and scripts used to plan the story line and visuals for ENTER THE MATRIX

consider how organized movie productions are. If you aren't organized and prepared to the same level, you can easily be shut out of the film production's inner circle, which will hinder the access you need.

If you are doing facial capture separate from your main mocap sessions, go to similar lengths in planning these sessions. The logistics of doing facial capture at the same time as your ADR work takes detailed planning, and again, costs can easily spin out of control if your technology and shoot days are not planned carefully.

ADR Recording

One of the most common types of assets licensed games gather nowadays is voice-over recording with the primary talent.

When setting up automatic dialogue replacement (ADR) sessions, be sure to plan your costs accordingly. Whether you are doing straight ADR or considering doing facial capture at the same time, choose your studio space accordingly. ADR is a fairly straightforward process, but things get complicated quickly when doing facial capture. Considerations need to be made to accommodate the facial capture rig, segregate the facial capture equipment in soundproof areas away from the main studio, and special cable runs may have to be planned to maintain the integrity of the ADR booth.

When planning your video reference assembly, be sure to check in with the film production. We got in lots of trouble during development because we assembled our video reference in a way that made sense to us as game developers. We later found out that the film people, primary talent, and ADR studio were used to working with a video assembly put together in a more traditional film format. Weeks of planning went down the drain, and we spent tons of time every night redoing the video assembly on a portable Avid to prepare for the next day. It was a classic case of fallout from inadequate planning between the film and game, where each group was used to working its own way for its own medium.

Finally, make sure to plan your shot list carefully. As with other types of asset gathering, don't try to get absolutely everything. You won't have enough time with the talent, and studio time is costly. Instead, plan your ADR script carefully, accounting for the gameplay lines you need, cinematic moments, grunt sounds for fights, and even promotional lines your publisher may want for commercials. If you're also doing facial capture, get a range of facial expressions and a phoneme list for your animators to use.

In interviews after our sessions were complete, Jada Pinkett-Smith described the ADR/facial capture process as "pure hell." This from an actress already familiar with the process from her work in productions such as *Princess Mononoke*. Game ADR can be pure hell, for no other reason than the number of variations needed for each line to be implemented in an interactive title. Understand the position the talent is in, and do them a favor by being as organized as possible.

That's a Wrap

We've just scratched the surface here — every area of asset acquisition and management is a subject unto itself. But any team placed in a situation with a film production similar to Shiny's will face the same fundamental challenges in gathering assets. Those teams can benefit from the lessons learned:

- Create a plan of attack, and pay attention to the details.
- Figure out what you need and what you don't need.
- Create in-house systems to deal with asset libraries.
- Be mindful of the unique environment and of the relationship with the talent.
- Explore cost-savings opportunities with the film production.

Film productions are masterful examples of organization, with plenty of fodder from which the gaming industry can learn. Gathering assets is just one slice of the pie — no matter the nature of the work, good planning and solid organizational principles will be the keys to mutually beneficial relationships with Hollywood in the future.

ACKNOWLEDGEMENTS

Thanks to the entire Shiny development team whose passion and professionalism helped make the lessons presented in this article successful in practice. Thanks also to Rosanna Sun at Eon Entertainment who advised me on dealing effectively with Hollywood people, whose wisdom is amply reflected here. Finally, credit for this production strategy's success also goes to the Wachowski brothers for their strong creative vision and commitment to pioneering new work pipelines.

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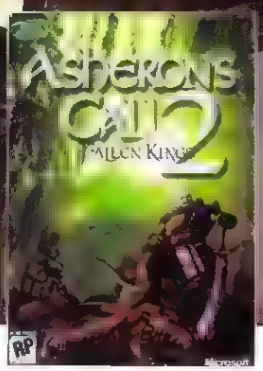


TOOL DATA

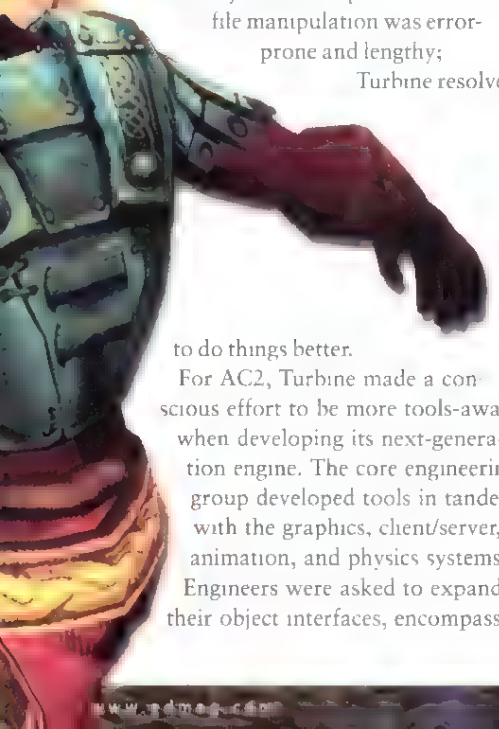
NUMBER OF FULL-TIME DEVELOPERS 1
NUMBER OF PART-TIME DEVELOPERS 10
LENGTH OF DEVELOPMENT 2 years
RELEASE DATE October 2002 still being modified
TARGET PLATFORM PC
MINIMUM HARDWARE 1.8MHz processors with 512MB RAM and various ATI and Nvidia graphics cards
DEVELOPMENT SOFTWARE MS Developer Studio Visual Source Safe Perforce Maya Bugzilla ICQ MSN Messenger the Turbine Engine

PAUL FROST Addicted to role-based adventure games at a young age, Paul [illegible] games and things. Lured by the promise of [illegible] programs — for games he [illegible] in 1998 he entered the industry working on children's edutainment software. Joining [illegible] Entertainment Software in 2000, Paul is now the [illegible] lead engineer and an Official [illegible] Turbine Elder.

The Tools Development of Turbine's Asheron's Call 2

Games bound for today's marketplace require the development of software tools. Whether the tool is a simple script to search text files for art asset file names, a complex model and animation exporter, or a massive world builder, these tools help game developers get the job done quickly and efficiently. The subject of tools arises in practically every *Game Developer* Postmortem, falling evenly into the "What Went Right" and "What Went Wrong" categories. Our tools development process at Turbine Entertainment Software underwent a lot of change during the Asheron's Call 2: Fallen Kings product cycle. This is what we learned.

During development of the original Asheron's Call, we created tools as needed — even the world-building tools were left until the alpha timeframe. While this off-the-cuff approach to tools development allowed the engineers to spend their time creating fundamental engine features, it left the artists and content designers out in the cold, forcing them to edit many text files by hand. The process of text-file manipulation was error-prone and lengthy; Turbine resolved to do things better.



For AC2, Turbine made a conscious effort to be more tools-aware when developing its next-generation engine. The core engineering group developed tools in tandem with the graphics, client/server, animation, and physics systems. Engineers were asked to expand their object interfaces, encompassing functionality not only for the client but for the tools as well. Tools-awareness was not limited solely to the core engineering group as it was with AC1.

We had several goals in mind while planning for AC2 tools functionality: First, we did not want to lag behind the engine development. The tools would reflect the current state of the engine, allowing users to test and use features immediately. Second, because AC2 would be much larger than AC1, we needed to speed up content iteration. The ability to preview and tweak engine assets without having to reload the client after each modification was critical. Finally, we wanted to hide the complexity of the engine from our users. Interfaces to revision control, logically organized dialog boxes, and a rendering window that was identical to the client facilitated use of the tools. We found that being so closely tied to the development of the Turbine Engine greatly benefited our tools.

What Went Right

1. Management and corporate buy-in. From the beginning, Turbine's vision for our internal tools was far-reaching. Many changes were being made to the Turbine Engine for AC2, so the idea of having a core engineer develop tools only part-time or wait until later in the content cycle was foolhardy and dangerous. We decided to create a dedicated tools position in the core engineering staff, recognizing that having a full-time engineer available for tools development would address many of the artist and content designer concerns. Instead of leaving tools development until the majority of the assets had already been created, the tools would be authored at the same time as the engine.

But what good is a full-time position without a plan? Turbine had several clear goals for the tools development process for AC2 and a roadmap to get there. We planned sufficient time, schedules, and resources for the process: we did not want to be developing tools at the alpha stage or spending nights and weekends cobbling together code to get the job done. We drafted milestones and goals for the tools that aligned to concurrently developing features in the engine. Through tool prototyping, we often discovered engine bugs early in the process. We also learned in the process that while schedules are nice, flexibility in tools development is critical; we often were required to rearrange our milestones and due dates based on functionality that the users needed "now."

Additionally, employees outside the core engineering group provided plenty of support. Artists, game systems engineers, and designers had helpful opinions and input into the tools development process. We brainstormed tool features and prioritized our lists. As the tools lead, I was able to schedule artists and designers to produce content used to prototype tools and work out bugs prior to their release. The company's support made my job that much easier.

2. Leveraging the engine code wherever possible. Turbine built the original set of world-building tools for Asheron's Call using the actual Turbine Engine game user interface. This presented a few problems: long compilations and tweaking screen sizes and positions made tools work unpleasant. Moving forward, Turbine decided that the tools should provide a consistent interface around an engine-rendered viewport. We developed the game on and for the Windows platform, so it seemed natural that the tools should be as well.

Several benefits were immediate: With the user interface and rendering engine separated, code could more easily be shared between the tools and the engine. WYSIWYG — what you saw in the tool-rendering viewport was what

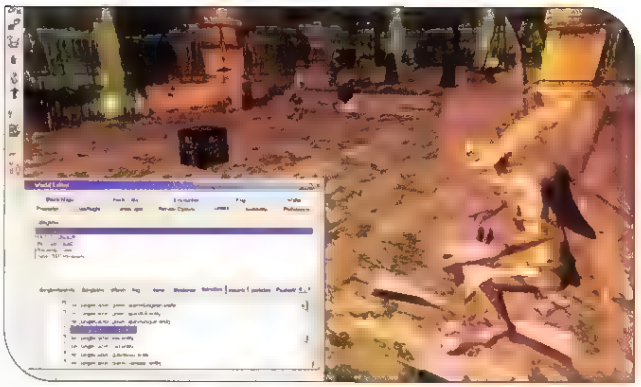
you got in the client. Many lighting and visual effects could be previewed and adjusted before building client data, which saved a great deal of time. The flexibility of Visual Studio allowed us to lay out dialog boxes quickly and gave us the ability to use window controls, such as listboxes and tree views, that weren't currently available in the Turbine Engine game UI. We also extended existing window controls to provide object information in new and logically organized ways. Using the English text representations of enumerated type data in listboxes aided the designers with easily understandable names, while at the same time prevented errors that would occur if those enumerated types were entered by hand into a text field. As a result, we dramatically reduced broken builds due to bad data.

A common API of virtual functions was provided for every object in the database. This made each instantiatable object "tools-compliant." Our world-building and art asset tools could query, modify, and update any object with the correct interface calls, which spawned one of the favorite expressions at Turbine: "Every engineer is a tools engineer." Engineers could use the common API to create new database objects with tools functionality built right in. Failure to fill in the API hooks resulted in debug assertions when an object of that type was loaded into the tool. Distributing the workload of tools development at the lowest level forced other engineers to provide previously omitted functionality. I would often find that providing functionality for a new object type became trivial; the majority of code had already been written.

3. Frequent tools design discussions. Turbine's internal tools cover a wide range of functionality. Art and content tools allow the user to preview and tweak all art assets before they are converted into the game data. World-building tools provide fast modification of terrain and the ability to place art assets into the game world easily. Engineering tools automatically generate code and data files and provide an interface to the source control system. At the beginning, there were hundreds of tools tasks that needed to be organized and prioritized.

Early in the tools development process we created two committees: one to address art and asset concerns and one to address world-building concerns. These committees met weekly, consisting of representatives from each functional area at Turbine: art, design, engineering, and game systems. The status meetings permitted opportunities to brainstorm new functionality, discuss problem areas and possible solutions, and reprioritize task lists and schedules. In this way, everyone felt they had input to the tools process, making it "our job" instead of "my job."

Keeping people up-to-date was a high priority. Daily status reports to a centralized mailing list let any interested artist or designer see what was happening to the tools. When new versions of the tools were checked in, another mailing list identified the new features, the bugs fixed, and the next required tasks. Each month, we prioritized the list of outstanding tasks and reshuffled the schedule, if necessary. We probably kept people too informed, but the adage "forewarned is forearmed" was definitely true.



Monster placement inside a dungeon in AC2

4. Feedback, feedback, feedback. Unlike Turbine's monthly episode cycle where the client program is released to thousands of subscribed users, all internal tools were built daily and provided only to those who wanted them. The customer wasn't hidden behind a bulletin board or an anonymous IP address. And, in some cases, my customer was the person sitting right next to me. When they were unhappy, boy did I hear about it. Continual feedback made the tools better, but we worked hard to create productive feedback loops.

One single point of contact existed for all tools-related questions, problems, and enhancements: me. While this provided me with the opportunity to extend my organization skills, it also gave the users comfort to know that someone was always looking at a problem. ICQ and MSN Messenger gave the artists and content designers a way to contact me at any time. However, walking over to a desk and checking out a problem is often the only way to catch a crash that has no good reproduction case. I made a point to provide feedback as soon as possible, even if I was just letting a user know I couldn't get to their problem immediately or that their enhancement would be added to the list of items to discuss at the next committee meeting.

A program crash is always unwelcome, especially when artists and content designers get in the groove of creating content. When a crash occurs, they will sigh, curse the program, and reload to continue what they were working on. I had no idea how often our tools crashed, and the users were more interested in getting work done than in reporting problems. We overcame mystery crashes by using a common "assert" dialog box in the debug versions of all Turbine's software: the tools, the client, and the server. This dialog box contained a stack trace, an optional message, and a Send E-mail button. Sending the e mail directed the contents of the dialog box to an internal mailing list. Program crashes still put out the artists and designers, but now there was a clear record of where — and sometimes how — the assert occurred. The entire core development team monitored the assertion mailing lists, which proved to be very useful. For critical problems, we set up the development environment on every machine in the office. If a problem needed resolution immediately, or there was no good reproduction case, we could break out of the assertion dialog box directly

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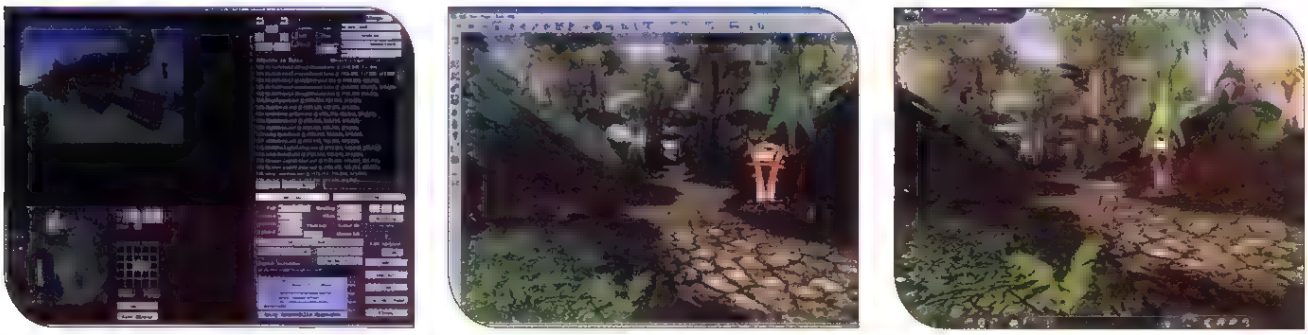


LEFT: AC1's world-building toolset. CENTER: The town of Zu seen from AC2's world-building tools. RIGHT: Zu as viewed in the AC2 client.

into the code and analyze the stack at that point. This was useful for debugging not only the tools, but debug versions of the client as well.

In some cases, the assertion mailing lists were insufficient to track the progress of a problem. When a problem severely affected the performance of the tools, we entered bugs into Bugzilla, the open source defect-tracking system. Bugzilla provided us with several important benefits: an HTML interface for reporting, modifying, and querying bug status; an e-mail interface to notify the appropriate engineers; and, because it's open source, a very attractive price tag. Once the baseline tools functionality was implemented, the ability to get a listing of bugs, priorities, and due dates was indispensable for organizing a daily or weekly task list.

5. We met our goals. There was a sense of accomplishment when ASHERON'S CALL 2: FALLEN KINGS moved from production to Live Team support, not only from the client and server teams, but with respect to the tools as well. "Meeting our goals" may sound trite, but the Live Team would be using the tools we produced going forward as they created content for the monthly episode cycles. A defined list of objectives let us systematically fulfill the needs of the artists and content designers.

Our first major goal was to speed up content iteration, which we did in several ways. To remove the possibility of entering bad data into the tools, menus and lists were pre-populated only with valid options. Allowing the database objects to reload in place from disk, artists could change models and textures behind the scenes, which eliminated the "modify, shutdown, reload" shuffle. Finally, overnight generation of data became possible by enabling batch processing of various assets.

Hiding the engine complexity from the user was our second major goal. By using an engine-rendered viewport in the tools, we guaranteed that content visualized in the tools would be identical to the client. We also created APIs into external tools; enabling us to add revision control functionality and remove some checkout/merge/check-in problems. Next, we presented coherently organized data; we imposed a visual structure on the data hierarchy and clarified our database inheritance scheme. Lastly, by modifying our build system, we were able to automatically get the latest code from source control, build any number of executables, and e-mail the user with a summary status at the completion of the job.

Overall, our internal tools development was worth the effort we put into it.

What Went Wrong

1. Coding before design. All the old lessons drummed into my head during school still apply: design in any complex software system is crucial and cannot be skipped. In the early phases of tools development, I tended to jump right into the code pile and start hacking out a solution to the problem. This caused no small amount of headaches when a seemingly small task blossomed into a days- or weeklong struggle.

Our art asset tools were originally limited in that we could edit and load only a single entity at a time. To speed content placement, it soon became apparent that we would need to create groups of entities. Doing so meant loading multiple objects into the tool concurrently and providing grouping/ungrouping functionality. I jumped into the task and finished in less than two days. When demonstrating the process to the users, it turned out that several important features had been skipped, prompting questions such as: What world-space position were the entities moved and rotated relative to? If one object in the group was selected, was the whole group selected? Did the tool remember if several different groups were created? My understanding of the problem wasn't complete and it showed. It was a frustrating lesson to be learned all around.

Obviously, more up-front design would have saved lots of time in this case. I now create a one-page, high-level summary of new features, which I have affected parties sign off on. A detailed design, usually down to the class and interface level, takes just less than a day. Applying this procedure cut tools development time by about 30 percent and drastically reduced the number of migraines I take home.

2. Feedback, feedback, feedback. As mentioned previously, creating our feedback loops was a lot of work. In the beginning, there wasn't much feedback from the users. Content designers did not realize that tools programmers didn't use the feedback functionality in the same manner; when the program crashed, they figured, "That's the way it is." Users found creative workarounds for various problems: "Don't press the 'V' key when your object is selected or it will crash." Later in the design process, I got a lot of requests for desired features which ended up being used rarely, if at all. During content crunch periods, feedback was nonexistent.

The dungeon creation process in AC2 highlighted a good example of feedback problems. Originally, the tech specified

400 objects in a dungeon, including all lights, decorations, creatures, and structures. However, late in the AC2 process, designers hated working on dungeons, especially when the number of objects ballooned to more than 1,000 objects: teleporting into and loading a dungeon location could take upwards of 20 minutes. Once loaded, rendering the dungeon yielded one to two frames a second; every object was drawn regardless of its distance from the camera. The content team shouldered these issues stoically, so I didn't find out about it until I had the chance to build a dungeon myself.

It turned out that the process of loading a dungeon recursively built an internal graph of data connections every time a new object was loaded. This system worked fine for 400 objects, but got worse the more objects were added. A few lines of code to pause the data graph construction during loading dungeons and functionality to cull objects at a user configurable distance dropped load times to 45 seconds and increased frame rate to a manageable 15 fps.

I have since learned to schedule some time for myself where I can use the tools in several different circumstances. There's nothing quite like getting a taste of your own medicine to spur improvements.

3. No good testing regimen. Insufficient testing plagues any software designed for internal use only. Many different trade-offs must be considered: How much time and effort is going to be spent testing a product that isn't going to generate revenue? Who is responsible for the testing of the internal tools, the developer or the quality assurance team? And how much of the QA budget can be utilized testing tools instead of the client?

The developer making the change in a specific area would usually test our tools and administer a functional overview test. Such limited and random testing didn't find many problems, so usually the users would end up being the alpha, beta, and production testers. Every so often we ran across problems big enough that they required several new versions of the tool to fully isolate and fix them. Having users on different versions of the code base led to several head-scratching dead-ends before the version inconsistency was recognized.

We started solving this problem with a growing internal QA team and the diligent use of bug-tracking systems for our tools.

4. Engine limitations. Wrapping a rendering viewport with a Windows system provided many bene-

fits, but ended up causing other problems. The world-building tools allowed users to switch between three different work spaces: an entity workspace to preview and tweak art assets, a world-building workspace that allowed content placement and terrain modification, and a dungeon-building workspace for assembling dungeons and placing creatures. Since the tool never knew what the user would be working on, massive amounts of memory were required to make sure all assets were preloaded, adding to the amount of time the tool needed to start up — going from double-click activation to "ready to work" took up to five minutes.

As I mentioned earlier, having the tools and engine closely bound was beneficial, allowing the core engineering team to find bugs in the Turbine Engine earlier. On the other hand, every memory leak or problem in the engine was exacerbated in the tools. One of the goals of the tools called for handling data errors cleanly and permitting the loading process to continue; users would be warned and their object would fail to load, but the program wouldn't crash. Such was not the case: text files that failed parsing by the low-level loader often caused a nonrecoverable crash, which required restarting the tools.

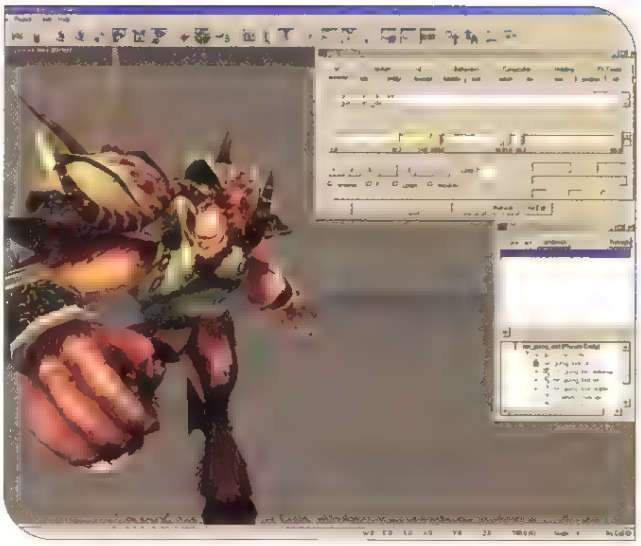
It also turned out that not all engineers were tools engineers. We found a few cases where one of the tools API functions returned "true" from a virtual function but provided no actual code. Developing a Windows application also has its own quirks and can be difficult for engineers unfamiliar with the framework.

Finally, we wrote the tools generically to handle core functionality that could be shared across games using the same version of the Turbine Engine. It turned out to be difficult to integrate game-specific functionality on top of the existing tool set.

Going forward, we have resolved to educate our engineers, create smarter objects, handle assets smartly and completely, and use profiling tools whenever possible. We're still working on the load times.

5. Lack of tools documentation. Implementing new features and fixing bugs requires the majority of tool development time. There doesn't seem to be enough time in the day to write documents and get the work done. "How-to" documentation takes a good amount of time to do well, and it's a task not everyone enjoys. The AC2 content process suffered from a lack of tools documentation, and since the tools knowledge had to be passed by word of mouth from content designer to new hire, we lost valuable time. There were a few short documents describing complex features, but roughly 30 to 40 percent of the functionality went unused because no one knew it was available.

Moving forward, we created an internal "tools news" mailing list. When new tools were compiled, the list was updated with the new version's features, bugs resolved, and short "how-to" information. However, not everyone read the mailing list, and I would regularly get questions for how processes worked and feature requests for tools that already existed. In the future, we hope to have more documentation and as a team be more committed to both updating and referencing it.



Editing an animation on the Gurog Lord using AC2's art asset tools

Tools of the Trade

As games become larger and more complex, the potential for build breaking errors becomes more and more likely. Software tools — both internal and external — can provide many features: error checking, error prevention, content generation, and productivity enhancements. If someone must do a repetitive, complex, or boring task, a software solution is ideal. During ASHERON'S CALL 2, Turbine vowed to be smarter about tools development and planned accordingly.

At Turbine, we devoted roughly 20 percent of our core engineering budget to tools work. With a dedicated engineer and a plan for tools functionality, we knew exactly what we needed to accomplish and how we hoped to do it. The team found that sharing code between the Turbine Engine and the tools saved a lot of time previewing and tweaking art assets. We learned that design is critical for any software project, not just our client software. Feedback and discussions gave everyone a vested interest in the tools. We've got some work to do for testing and documentation, but we're moving in the right direction.

Tools developers know theirs isn't the most glorified position in a game company, but it is one of the most critical. People at fan gatherings don't want to talk to you, and half the people in your company don't know exactly what you do. Your job can be the bottleneck that strangles a game, and you may ask, "Is it worth it?" A content designer once told me that in the original ASHERON'S CALL, he destroyed the town of Arwic using the first generation terraforming and content placement tools. Time spent? One week. Modifying a similar set of terrain for ASHERON'S CALL 2 with the new tools took an hour and a half. I'd call that improvement.

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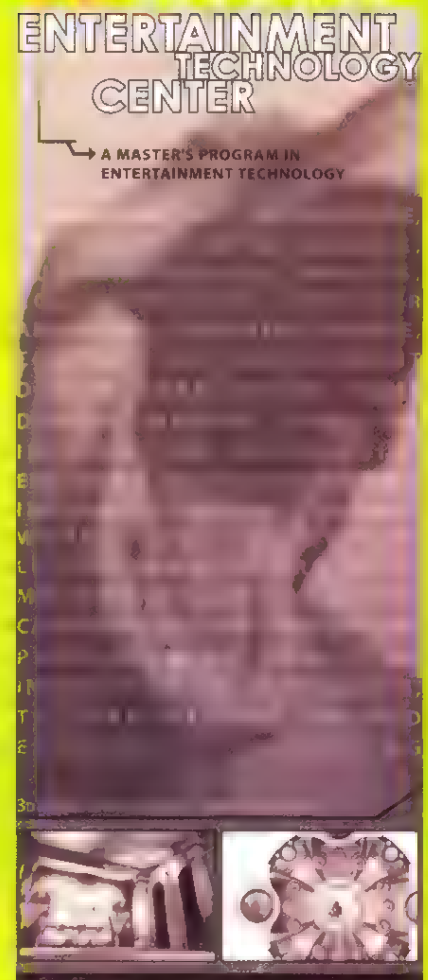

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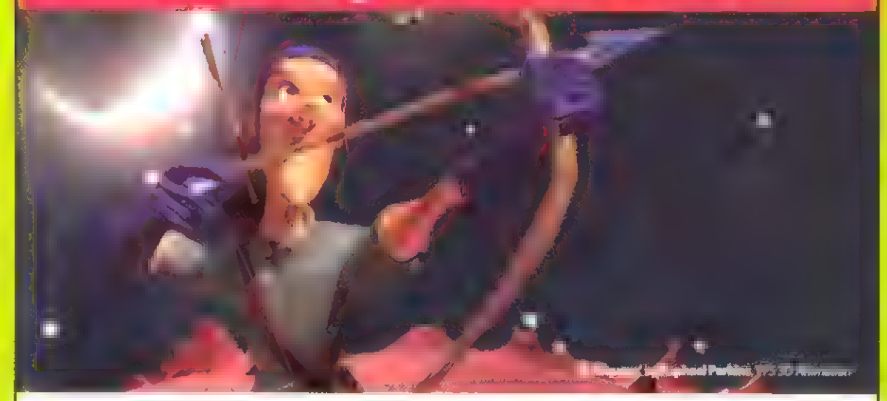

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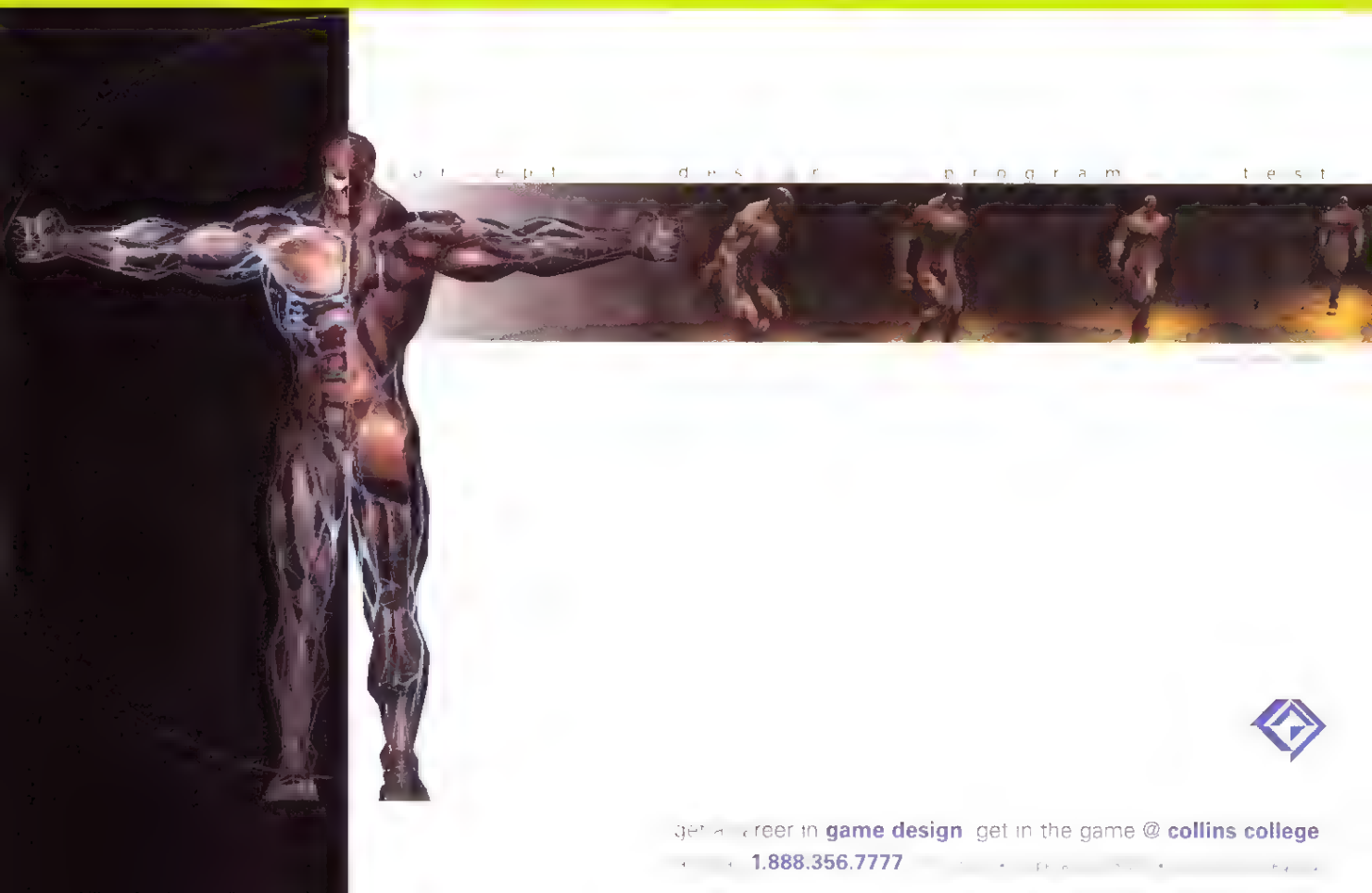

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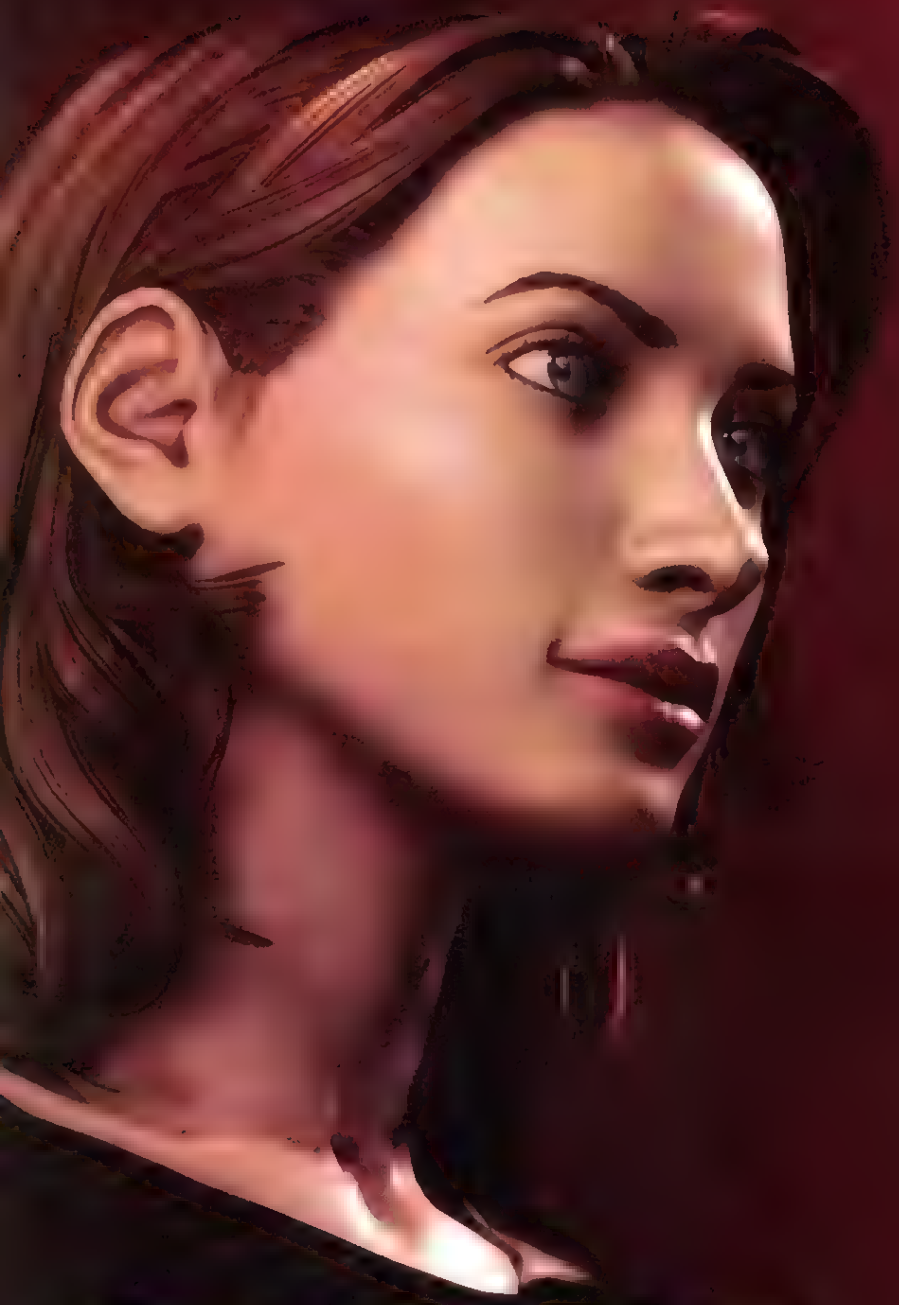

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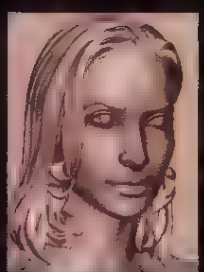
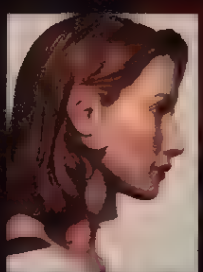

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continued from page 56

The "pleasurable frustration" principle. Players are most motivated to learn and keep learning (and keep playing) when the game operates within, but at the outer edge of, their sphere of competence. The feats facing them must feel doable but challenging at the same time, giving rise to a constant sense of pleasurable frustration. Players should be able to customize games according to their own levels of competence and their learning and playing styles. This is not just a matter of having different difficulty levels; it is also a matter of allowing multiple solutions to problems, of offering differential rewards for different levels of play, of giving choices about save systems, and of offering regular feedback about the player's progress. Games should get progressively harder for those doing too well or ease up a little for those faring poorly.

The "sandbox" principle. For cognitive science purposes, sandboxes describe little bounded pieces of the real world where one can explore while still feeling safe. In a game, the first or early levels of a game should serve as the player's sandbox. Tutorials are great so long as they give just enough information to get players quickly learning by playing. When a game's first level or levels serve as virtual tutorials, players feel they are actually playing the game when in fact they are being tutored on how the world works. Players feel at risk, but the risks are really minimal. Sandbox levels offer players lots of examples of the basic elements of the game, so they can later concentrate on the new, special, and harder aspects they will face in subsequent levels (this is called a "concentrated sample" in the cognitive research field).

Motivation: Saving the Best for Last

The learning principles of a good sandbox, the cycle of expertise, pleasurable frustration, and others like them are actually part of what makes a game feel "deep," and hence enjoyable and memorable. For humans, the best learning is playing, and the best playing is learning.

The most important factor that drives learning is motivation; when motivation dies, learning dies and playing stops. One of cognitive science's definitions of motivation (it is one of those hard-to-pin-down words) is a learner's willingness to make an extended commitment to engage at a personal level in a new area of learning. Players immersed in good games can help us study how motivation in this sense is created and sustained, since good games appear to be highly motivating to a great many people.

When playing a videogame, players engage in "action at a distance," much like remotely manipulating a robot, but in a far more fine-grained fashion. Cognitive research suggests that since perception and action are deeply inter-connectedfor humans, this fine-grained action at a distance actually causes humans to feel as if their bodies and minds have stretched into a new space. Books and movies, for all their virtues, cannot do this. The more a player can manipulate a character and the more the player's decisions impact on that character, the more the player invests in the character and the game at this biological level. This investment forms the deepest foundation of a player's motivation to stick with and eventually master a game. In this sense, failing to build good characters risks losing the biggest advantage a game has.

Cognitive science owes a considerable debt to the game industry for providing large scale validations for its principles and theories in action. At the same time, game developers' conscious application of these principles and theories stands to return the favor by delivering compelling learning and emotional experiences unique to human behavior.

JAMES PAUL GEE | *James is a professor of education at the University of Wisconsin-Madison. A linguist by training, he has published extensively on issues dealing with language and learning. His most recent book is* What Video Games Have to Teach Us About Learning and Literacy *(Palgrave/Macmillan, 2003).*

ADVERTISER INDEX

COMPANY NAME	PAGE	COMPANY NAME	PAGE
Apple	C2–1	Michael H Golland	54
Academy of Art College	51	Microsoft	19, 41
Anthro	11	New Pencil	54
Carnegie Mellon	49	Perforce	5
Collins College	52	Premier	17
Dell	8–9	Programmer's Paradise	7
Discreet	21	Qualcomm	3
DTS	27	RAD Game Tools	C4
Edge of Reality	49	Savannah College of Art & Design	50
Full Sail Real World Education	50	Secret Level	15
Hewlett Packard	45	Softimage	C3
i2i Animation	54	Stottler Henke	47
Illinois Institute of Art	53	University of Advancing Technology	52
LucasArts	54	Vancouver Film School	52

Turning Games into Learning Machines

Cognitive science is the study of how human beings learn and think. Cognitive scientists study learning and thinking in laboratory experiments and out in the world by designing and testing new ways of learning in workplace and classroom settings. Though game developers can learn a good deal from cognitive science about how to get more people to learn and enjoy their games, cognitive scientists can learn a good deal from good game developers about how their theories can be applied to how people learn.

HOMEWORK
1. Find alternate route thru forest
2. Solve treasure chest puzzle
3. Defeat guards
4. Spend gold on new stuff or hire party?
Jon's Cognitive Skills

I am a cognitive scientist who, at the ripe old age of 53, started playing videogames. Much to my surprise, I discovered many modern games to be long, complex, and challenging endeavors. Judging by their increasing popularity, millions of people willingly go through the process of learning how to play these games. Otherwise, no one would be buying them and a lot of you reading this would be out of a job.

Good videogames encourage types of learning and thinking that are important in today's fast-paced world. Today's young people — who were raised on and still are consumers of videogames — are often better at these types of learning and thinking than their baby-boomer parents. However, this is not because games operate at "twitch speed." I play PIKMIN less well than my seven-year-old son, and twitching has nothing to do with it; he is simply better at exploring and problem-solving in the game's world than I am. Good games tend to encourage exploration rather than straightforward movement to a goal. They encourage players to redefine goals as they move forward, to seek multiple routes to goals and multiple solutions to problems. In fact, many game developers would not consider it an honor to have their game described as "linear." In today's world, where everything interacts in complicated ways with everything else, such nonlinear thinking is a requisite for progress.

We — both the game development industry and cognitive scientists — have a lot to learn from how good games are designed to enhance learning and how they can be made even better. This research will in turn lead to more engaging and better-playing games. It will also lead to the realization of the immense and innate potential that games have as learning tools, both inside and outside classrooms.

Why Games are Great Learning Machines

Games like RISE OF NATIONS, DEUS EX, or SYSTEM SHOCK 2 have a plethora of good learning principles built into them, principles that reflect what cutting-edge cognitive research has discovered about what causes deep human learning:

The "cycle of expertise" principle. Learning is not primarily about tutorials. Cognitive scientists know that humans enjoy learning experiences that revolve around the "cycle of expertise," a cycle comprising five different stages, which can be applied to game situations as follows: Beginning in stage 1, players are confronted with problems specifically designed to make them form good generalizations about the game, generalizations that will really pay off for them later on when the gameplay becomes more advanced. During stage 2, players are made to solve related but varied problems until they attain a routinized mastery of these problem-solving skills.

In stage 3, game designers will throw a new problem at players that requires both those previously acquired skills and the development of new ones. By doing this, they make players reopen their existing cognitive tool kit and expand it with new skills. These new problems, with variation, are now repeated enough to create a new routinized tool kit in stage 4. In stage 5, the whole cycle is repeated. Though these stages exist in most kinds of deep learning, in a game it means that learning and playing become synonymous for the duration of the game as players move up a ladder of increasing learning and mastery.

continued on page 55

Illustration by Claudia Newell

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